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Electrical World

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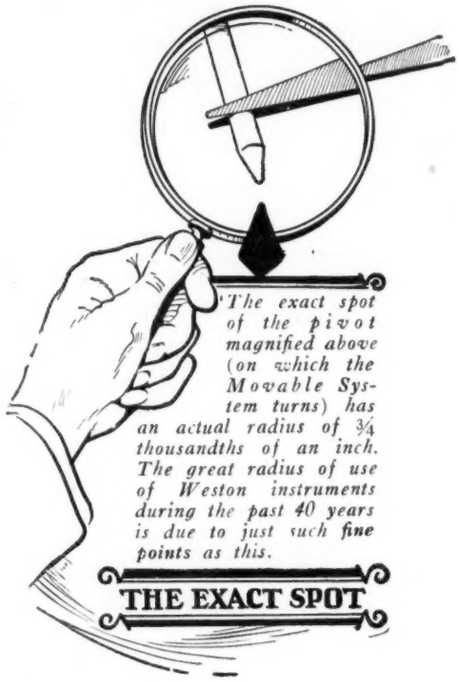

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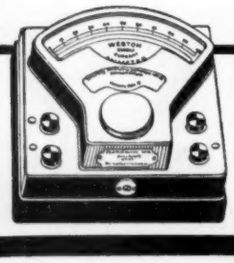

STANDARD THE WORLD OVER

WESTON

Pioneers since 1888

Electrical World

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W. H. ONKEN, JR.
Editor

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Great Britain Honors Elihu Thomson

THE presentation of the Faraday medal to Prof. Elihu Thomson in England early this month exhibits not only Great Britain's appreciation of merit but her catholicity as well. Thrice has England honored this American savant; in 1924, with the Kelvin gold medal, and a little earlier, with the Hughes medal of the Royal Society. Nor has America itself been slack in bestowing medals and other honors on her distinguished son. It is in recognizing merit in others, however, that Great Britain reveals her greatness and sets an admirable example to all other nations.

And how proud the electrical industry is of her Swampscott professor, inventor, philosopher and friend. Of all men living, none except Edison has brought her so much honor and renown. The Faraday medal carries with it no suggestion of intrinsic value, for it is of bronze and not of gold. Were it of iron it would be none the less coveted, because the Institution of Electrical Engineers has bestowed it upon such illustrious men as to place it beyond price. The medal commemorates the foundation of the Institution and is given for world-wide services to electrical science and engineering. Obviously no man is more deserving of such an honor than Professor Thomson, We extend to him our felicitations and congratulate the Institution of Electrical Engineers of Great Britain on the wisdom of its choice.

Secondary Voltage Surveys

IN VIEW of the changing ideas in the industry regarding the importance and value of residential load, proper voltage on secondary lines becomes a condition to be taken into account. Aside from the effect on revenue, secondary voltages deserve consideration from the standpoint of service. A central station is hardly likely to build up a large residential load, utilizing all of the many domestic appliances on the market, unless energy is supplied at voltages which permit satisfactory use of these devices. And no central station can afford to delude itself into the belief that there is time enough to think about secondary voltages when large numbers of domestic appliances are on the lines.

Voltage surveys should be made annually, generally speaking. And it is essential that the survey covers the territory and is not merely a collection of readings taken close together in one alley. Observations should, of course, be made in winter when the residential peak is on. To be of value the readings should cover one-tenth of the customers in each area and should be regularly spaced along the secondary lines irrespective of transformer locations.

The value of voltage survey records is great. They present a picture not only of service conditions but supply the accurate data on which to base changes and rehabilitations. Most important of all, however, they give the management an inkling of service conditions and enable it to increase good will as well as revenue.

The Weak Commercial Skirmish Line of the Electrical Industry

TIMES are changing in the market for electricity and the power companies are beginning to suffer because the old process of growth by accumulating residence customers is petering out. The diminishing number of houses that are now being wired, because so few are left unwired within reach of power lines, is forcing the central-station industry to recognize the increasing importance of the sales function. For future growth must come largely from the intensive selling of a broader service to present customers.

And now manufacturers of many kinds of wiring materials are also beginning to feel the pressure of the same conditions and to blink at the same facts. There is overproduction today of wire and lamp cord and armored cable and conduit. There is overproduction of plugs and sockets and standard porcelain and kindred lines. There is overcapacity to produce and too much competition for existing business. There is too little creative selling of the sort that builds new and broader markets and develops greater use by present customers.

Electrical men are commencing to realize that, like the power industry, the manufacturing industry has also had too much engineering leadership that has been overshadowing the sales function. And as a result, this great manufacturing group that provides the material of all kinds that enables electricity to enter the home and serve the American people is suffering from a similar commercial blight. It is badly handicapped today in its distribution and its merchandising by a weak commercial skirmish line in the communities—weak because it has not been nourished to strength through the past years.

To move the material into the homes in adequate wiring installations and to put in circuit complete equipments of electrical appliances the manufacturer must rely upon the help of the local jobber, dealer, contractor and central station. And all of these electrical retailers and installers are backward merchandisers, as classed against the progressive local agents of so many other industries. The electrical industry has advanced a very far-flung firing line in this two-fisted battle of American business for the favorable consideration of the family budget, but as an army it is weak in barrage, loosely co-ordinated and but poorly served in either intelligence or supply—to use the army terms.

It is no time for tears, however. It is a time for action. And the first thing is to find and face the facts of the broad situation and then to set about methodically organizing, equipping and supporting this firing line in

an aggressive campaign based on offensive tactics. There will be continuing and increasing need for strong sales leadership throughout the electrical industry from this time on.

Coal Dissolution

COAL does not dissolve into thin air to be wafted away in the gentle breezes. Coal is definitely objective material, heavy and stolid, with very limited ethereal qualities at atmospheric temperatures, and it does not fade like a dream, and yet many an electric utility has discovered that it has bought and paid for a much larger amount of coal than it has burned. Power house records show the tonnage used and the purchasing department books show the tonnage bought; but the yard does not contain the several thousand tons difference. What has become of it?

The reason for the large discrepancy between coal bought and coal burned is that the year's purchase and the year's use are brought together for comparison in lump totals. Although coal is weighed into the yard and weighed out, the first measurement is in large quantities at intervals and the second in lesser amounts continuously. The cumulative error naturally is greater in the sum of the larger number of weighing operations than in the lesser number. Add to these errors the possible actual difference in coal weights caused by moisture lost during yard storage and there is the possibility of real trouble in accounting. One utility which was confronted with this problem has now established the practice of justifying and reconciling coal weights each month. The errors are there, as before, but they are ironed out and absorbed almost as fast as they occur and before they pile up to a formidable total.

Farm Electrification—A Look at the Seamy Side

VISITS to some of the farms on which pioneer work is being done in electrification bring to light the very definite fact that the farmer still possesses his traditional abhorrence for spending money and is perfectly willing to get along with makeshifts. His principal objection to rural electrification is cost. He has to make a large cash expenditure in order to get the service and usually makes the most of his opportunity to economize in the purchase of equipment and distribution layout. The result is trouble and disappointment. One may see a pair of wires strung loosely up the inside of the barn wall and through a knothole across to the steel frame of a windmill, then down through an open one-inch water pipe to a pump motor, with no bushing to prevent abrasion of the wires or entrance of rain. In another installation an ordinary type of motor with no protection from the weather was placed in the barnyard and belted to a pump jack. Being small, the motor is controlled by a snap switch fastened with one screw to an upright board. A pumping outfit is operated by a motor unprotected from the weather, the wires feeding the motor being brought out through an open window of a shed. The feeders, however, being too long, the bight of the wires is coiled up like a clothes line and hung on a nail driven into the side of a shed.

If the farmer is not to be woefully disappointed in his expectation of what electricity may do for him, he will have to learn that electricity improperly handled can be a destructive as well as a beneficent agency. There is need for a code governing electrical installations on the farm. Because there is no community peril when the buildings on one farm go up in smoke the necessity for regulation is not recognized. Most farm properties, if they are insured at all, are insured in mutual or cooperative companies owned by the farmers themselves. The organizations of these companies are often incoherent and rules are not rigidly enforced. It is, therefore, necessary that something be done to raise the standard of electric wiring on farms and to make better provision for the use and maintenance of electric equipment.

Purchasing Agents Have Their Say

ENGINEERS are accustomed to look down upon the purchasing agent as an obnoxious handicap to progress. At the convention of the National Association of Purchasing Agents in Grand Rapids recently these men told their side of the story. Very frank opinions to the discredit of the business sense and executive capacity of engineers were expressed. In the opinion of many purchasing agents the engineer sits down and writes out specifications which are designed to show his ability to be different, inventive and ingenious. Standards are abhorrent to the engineer, for they do not permit him to show his technical talents. He subordinates business sense and cost reduction to professional vanity and growls at the purchasing agent who checks up on the specifications from the standpoint of costs and standardization. It was intimated also that engineers have made a mess of national standardization long enough and it was time business executives took hold of the standards situation. Electric light bulbs and bricks were cited as examples of what standardization would mean if conducted in a logical manner.

These comments of purchasing agents and corresponding comments of engineers about purchasing agents indicate that a "get together" meeting is needed. There is truth in both sides of the case, and a meeting of minds on a friendly basis would help clarify the atmosphere. Engineers should invite purchasing agents to speak at their conventions, and purchasing agents should hear engineers tell their story. The situation is a natural condition resulting from the modern trend to isolation of business groups. It can be and should be improved.

Psychological Value of Interconnection

INTERCONNECTION of transmission systems has a commercial value not readily computed in terms of capacity saved or as a physical precaution against service interruption. Its psychological effect, however, may be very great. Recently a large industrial power user contracted with an electric utility for 20,000 kw. of maximum demand. This industrial plant had previously declined to consider purchased power, although negotiations had been carried on for a number of years. When, however, the power company effected an interconnection with another utility, involving a tie-in cost of $350,000, the contract to supply the industrial plant with 20,000 kw. was closed, as the customer felt that he now had sufficient assurance of service continuity.

Since the interconnection was effected, nearly two

years ago, power has been transmitted over it only once, and then into the other system. But the customer knows that the connection is available and that another power supply can be drawn upon if occasion arises. Here is an investment of more than a third of a million dollars which resulted in a power contract that will return approximately a million dollars in gross revenue per year. Interconnection has well-recognized engineering and operating advantages, but it is not often that such a clear case of commercial advantage presents itself.

Recording Instruments Are No Longer a Luxury

CONSPICUOUS among the evidences of broader-visioned industrial management lately apparent is the increasing use of recording instruments. From early days electric utilities have been "sold" upon the value of graphic devices, owing to the necessity of measuring an invisible product in important stages of its progress from prime mover to translating device. It is safe to credit the electrical industry with much of the present hospitality of broad-calibered industrial executives toward instrumentation, since by this means the user of power exercises an increasingly close control over many vital processes and services.

Electrical instruments have truly become the stethoscopes of the industrial body politic, with its intake and digestion of raw material, its production of valuable output and circulation of useful commodities. In this way many customers of central-station companies have derived an auxiliary benefit from the purchase of energy through the doing away with haphazard estimates or crude measurements of process requirements. In many large industries superintendents of power and electrical engineers have been quick to sense these values and even to lead the way, and now the gospel of graphic measurement is swiftly spreading all through the world of business and manufacture.

Time was when a plant engineer often approached the managerial office prepared to dodge verbal bricks in recommending the purchase of recording instruments beyond those imperatively needed to enable the concern to function at all well. Today most of the citadels of hair-trigger opposition have given way to progress in organizations whose management rises above low grade. Men buy with intelligence and with perspective as never before, and soon only the misinformed will dare to put adequate instrumentation in the class of luxuries.

The Oil Burner Load

THE introduction of the oil-fired furnace for residential heating brings with it several central-station problems that deserve consideration. Thanks to the recurrent strikes and threats of strikes, the coal industry has been playing directly into the hands of the oil burner manufacturers and, through them, of the electrical energy supply companies.

First of all, more information is needed on the characteristics of the oil-burner motor as a load. How much energy does it take? What is its use-factor? How will the demands of a group of such motors overlap? How will they affect existing peaks due to lighting? Given the basic information, an intelligent plan of campaign can then be mapped out.

It may as well be recognized that a merely negative attitude toward the oil burner will get nowhere. The burners are going in, thanks to energetic salesmen, and for the central stations it is a question of knowing what is going to happen instead of waiting until after it has happened. A few charts made with recording instruments in typical houses, and under a variety of climatic conditions, will be worth more than any amount of speculative discussion. If any such records have been secured it would be a timely contribution to make them public before the heating season is upon us.

The home that relies on electricity for the functioning of its heating system as well as for its light and the operation of appliances has taken almost the final step in making itself dependent on central-station service. The added opportunity brings added revenue, but it also brings increased responsibility for continuous energy supply regardless of storm and weather. Meanwhile a device that can add some 25 per cent to the energy consumption of a given residence is not to be ignored. Started by time clock in the early morning and running more or less continuously until the family retires, it ought to add just that type of long-hour load so much desired, for furnaces are in use in many sections half the year.

Portable Lamps Demonstrate Desirability of Shaded Light

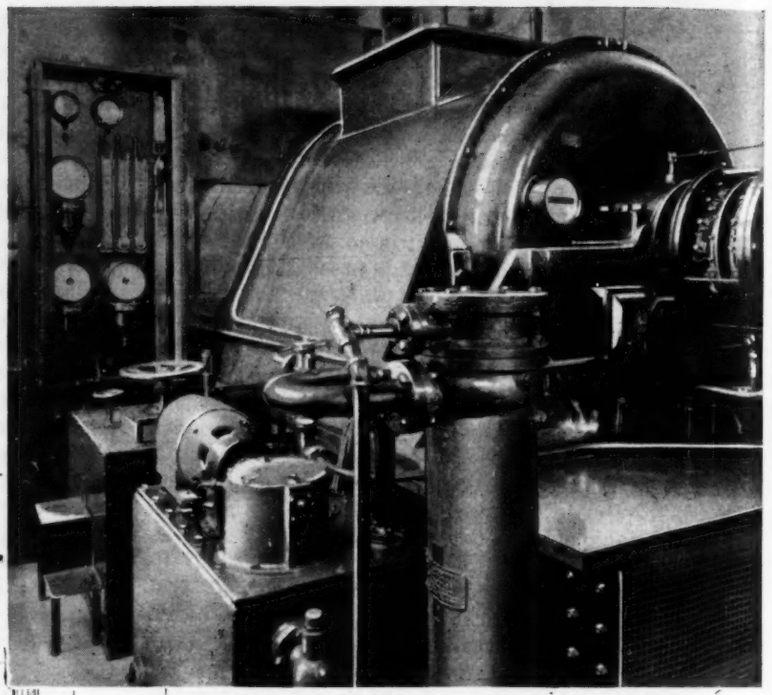
IT HAS taken certain branches of the electrical industry interested in lighting a long time to learn that more and better lighting involves proper shading and diffusing of light. For example, lighting fixtures have been designed and sold without shades. Even some "modern electrical homes" have been opened to the public without demonstrating the desirability of shades on certain brackets and ceiling fixtures. After years of effort on the part of certain exponents of good lighting the electrical industry is beginning to awaken and bestir itself to the commercial possibilities of better lighting. The homes of this country need more light, but this cannot be sold easily and permanently unless the principles of good lighting are used as a vehicle.

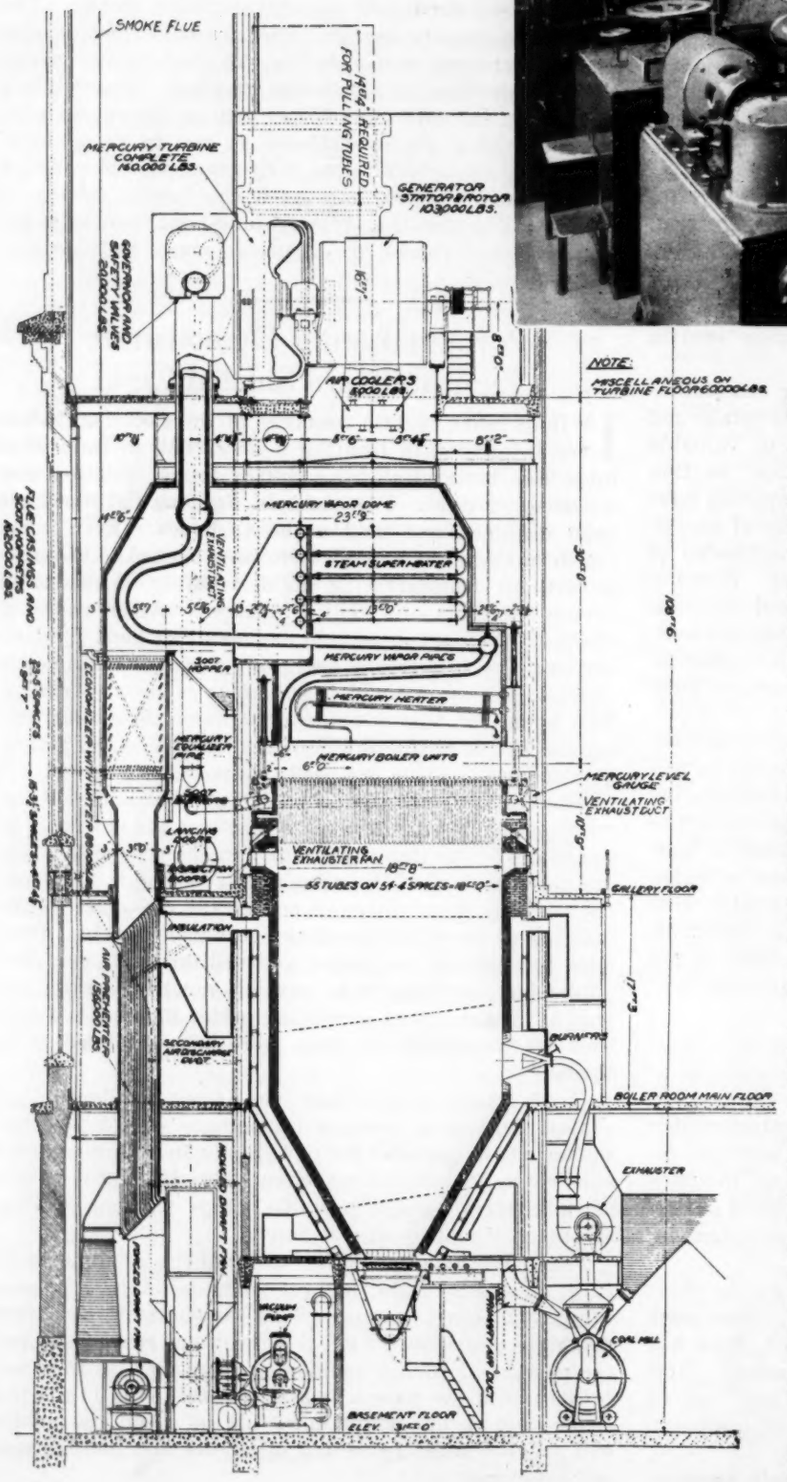
The public is not alone in its ignorance and indifference. Many persons in companies which are in a position to aid the better lighting activity in the residential field are not conscious of the value of shaded light. To these the portable lamp conveys a convincing message. Many millions of these are entering the homes yearly. They have a combined decorative and utilitarian value. The public has accepted them without much effort on the part of organizations promoting better lighting. Would they be acceptable if they were not equipped with shades?

Every dealer or salesman who is not convinced that shaded light is of primary importance should take the shades off the portable lamps in his home. How unbearable would he find this condition of glaring light! Then he might try to sell portable lamps without shades. Again he would learn a lesson.

There are many scientific and esthetic arguments in favor of shaded light, but the portable lamp supplies a simple and convincing one. That the public has accepted portables and shaded light is a dominant reason. When the portable is turned upside down and its base fastened to the ceiling we have a ceiling fixture. Why is not the shade just as important now? It is. And the public will prove it when habit and ignorance and indifference are overcome.

Mercury-Vapor Equipment for South Meadow Station





CONSTRUCTION work is progressing on the new mercury boiler and turbo-generator unit for the South Meadow station of the Hartford Electric Light Company. A total steam and mercury power output of about 20,000 kw. is to be realized by the use of this installation. The new turbo-generator is being built by the General Electric Company and the boiler by the Babcock & Wilcox company according to the designs of W. L. R. Emmet. From the accompanying drawing it will be seen that the complete unit at South Meadow will have an over-all height of about 108 ft. Pulverized coal will be burned and the guaranteed efficiency of the equipment will be such as to yield 1 kw.-hr. for a little less than 11,000 B.t.u. The Dutch Point generator shown has a rating of about 1,800 kw. Data for the South Meadow unit are given in the accompanying table.

DATA FOR SOUTH MEADOW UNIT

Output of mercury turbine, kw.	10,000
Speed of mercury turbine, r.p.m.	720
Steam produced per hour, lb.	125,000
Steam pressure, lb. gage	350
Steam temperature, deg. F.	700
Mercury vaporized per hour, lb.	1,150,000
Temperature mercury vapor, deg. F.	884
Pressure vapor at mercury turbine, lb. gage	70
Vacuum in mercury condenser, in.	28
Temperature mercury exhaust, deg. F.	458
Gas temperature beyond mercury liquid heater, deg. F.	950
Gas temperature beyond steam superheater, deg. F.	650
Gas temperature beyond water economizer, deg. F.	480
Gas temperature to stack, deg. F.	280
Air temperature entering furnace, deg. F.	390
Coal burned per hour, lb.	14,500
Heat in coal per pound, B.t.u.	14,500

At left, cross-section of South Meadow installation. At top, pioneer mercury-driven generator at Dutch Point.

Auxiliary Power at Richmond Station*

Design of System—Starting of Large Motors at Full Voltage from Auxiliary Turbo-Generator—Tests and Conclusions

By J. W. Anderson and A. C. Monteith†

RICHMOND station is located in the northeastern section of Philadelphia along the Delaware River, about five miles from the central part of the city. At the present time the capacity of the station is 120,000 kw., made up of two turbo-generators, each rated 60,000 kw., 0.85 power factor, 13,800-14,400 volts, three-phase, 60 cycles, 1,800 r.p.m. Ultimately the plant will have a rating of at least 720,000 kw. and will consist of three separate building sections, each housing four turbo-generators having ratings of at least 60,000 kw. capacity each.

The first building section, which was completely constructed in the initial development, comprises three main parts—namely, boiler room, turbine hall and switch house, with the boiler room nearest the river. Ultimately the boiler room will house 24 boilers. Twelve boilers have been installed initially, each rated at 1,570 hp. and equipped with a superheater, an economizer and an air preheater. Two induced-draft and one forced-draft fans are provided per boiler. Included in the turbine hall and its mezzanine galleries and basement are the main generating units, condensers with their pumps, river and city water pumps, air compressors, auxiliaries, heaters, evaporators, deaërators, boiler feed auxiliary power generator and buses, generator and exciter field rheostats, main generator ventilating equipment, etc. In the switch house are installed duplicate 13,200-volt buses, oil circuit breakers, disconnecting switches, reactors, etc., all arranged for vertical phase isolation. A connecting building between the turbine hall and the switch house contains the direct-current power room, battery room, pipe room and operating room. Transformers supplying all 2,300-volt auxiliary power load and induction regulators for the three tie lines to Delaware station are located outdoors between the turbine hall and the switch house.

As installed, the auxiliary power system at Richmond station consists of five principal parts as follows:

1. A 2,300-volt, three-phase, 60-cycle supply for boiler fan motors and large, less essential, auxiliaries.
2. A 2,300-volt, three-phase, 60-cycle supply for essential auxiliaries.
3. A 230/115-volt, two-phase, 60-cycle supply for small auxiliaries, lighting, etc.
4. A 250-volt, direct-current supply for stoker motors, emergency excitation, etc.
5. A 250-volt, direct-current supply for control of oil circuit breakers, etc.

The 2,300-volt supply for boiler fan motors and large, less essential, auxiliaries, such as motor-generator sets, fire and water pumps, is obtained from three (ultimately four) 3,750-kva., oil-immersed, self-cooled transformer banks located between the switch house and turbine hall and supplied from the main 13,200-volt buses in the same manner as outgoing lines. These banks feed duplicate sectionalized 2,300-volt buses located between turbine hall and the boiler room so that cable runs are of minimum length.

The 2,300-volt supply for essential auxiliaries is laid out on the unit principle. A 2,500-kva., oil-immersed, self-cooled transformer bank, also located outdoors between the switch house and turbine hall, is connected directly to the terminals of each generator and supplies a short bus installed on a gallery under the turbine hall floor. All essential auxiliaries associated with the generating unit are connected to this bus. To supply these auxiliaries while starting the unit, and also to act as reserve sources, each of these unit auxiliary buses is provided with two ties, one to the general 2,300-volt system and one to another 2,300-volt bus to which the auxiliary turbine generator may be connected. Thus

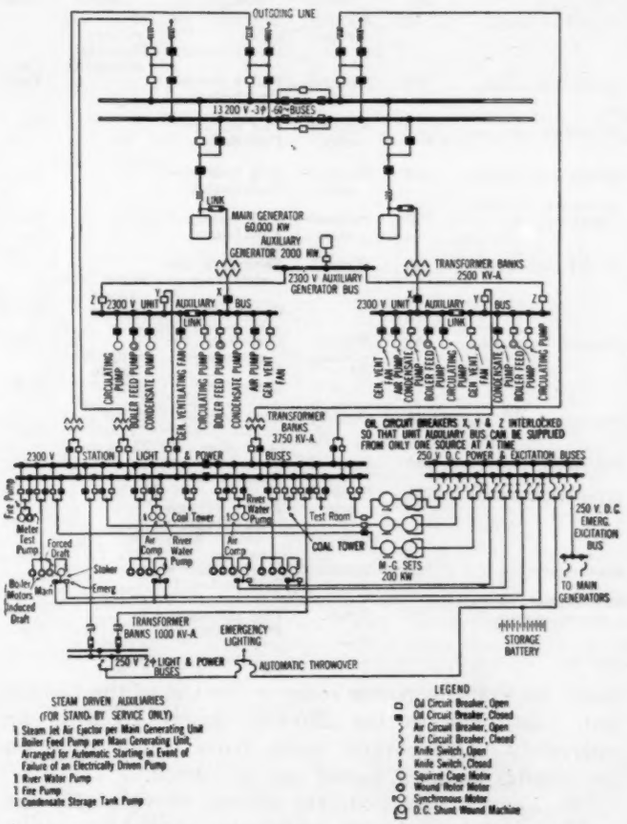

OUTGOING LINE
13 200 V -3Φ - 60 - BUSES
LINK
MAIN GENERATOR 60,000 KW
AUXILIARY GENERATOR 2000 KW
2300 V AUXILIARY GENERATOR BUS
TRANSFORMER BANKS 2500 KV-A
2300 V UNIT AUXILIARY BUS
CIRCULATING PUMP
BOILER FEED PUMP
CONDENSATE PUMP
GEN. VENTILATING FAN
AIR PUMP
GEN VENT FAN
TRANSFORMER BANKS 3750 KV-A.
OIL CIRCUIT BREAKERS X, Y & Z INTERLOCKED SO THAT UNIT AUXILIARY BUS CAN BE SUPPLIED FROM ONLY ONE SOURCE AT A TIME
2300 V STATION LIGHT & POWER BUSES
250 V D.C. POWER & EXCITATION BUSES
Fire Pump
Meter Test Pump
Forced Draft
Stoker
Emerg
Boiler Motors Induced Draft
Coal Tower
River Water Pump
Air Comp
Test Room
COAL TOWER
M-G SETS 200 KW
250 V D.C. EMERG. EXCITATION BUS
TO MAIN GENERATORS
TRANSFORMER BANKS 1000 KV-A.
EMERGENCY LIGHTING
STORAGE BATTERY
250 V 2-φ LIGHT & POWER BUSES
AUTOMATIC THROWOVER
STEAM DRIVEN AUXILIARIES (FOR STAND-BY SERVICE ONLY)
1 Steam Jet Air Ejector per Main Generating Unit
1 Boiler Feed Pump per Main Generating Unit, Arranged for Automatic Starting in Event of Failure of an Electrically Driven Pump
1 River Water Pump
1 Fire Pump
1 Condensate Storage Tank Pump
LEGEND
Oil Circuit Breaker, Open
Oil Circuit Breaker, Closed
Air Circuit Breaker, Open
Air Circuit Breaker, Closed
Knife Switch, Open
Knife Switch, Closed
Squirrel Cage Motor
Wound Rotor Motor
Synchronous Motor
D.C. Shunt Wound Machine

FIG. 1—STATION AUXILIARY SYSTEM, NORMAL OPERATION

*Abstract of paper presented at the summer convention, A.I.E.E., Detroit, June 20-24, 1927.

†Mr. Anderson is connected with the Philadelphia Electric Company and Mr. Monteith with the Westinghouse Electric & Manufacturing Company.

each unit auxiliary bus has three separate sources of power. The breakers controlling these sources are interlocked so that normally no two of them can be paralleled, although provision is made to alter the interlocking by a synchronizing plug in case it is desired to parallel the auxiliary generator with the general 2,300-volt system. In starting up a generator, the unit bus is usually supplied from the general 2,300-volt system, and after the machine has been synchronized and connected to the station bus, the unit bus is connected to the transformer bank on the generator terminals. Suitable relays give an audible alarm in event of failure of voltage on the unit bus.

The 230/115-volt, two-phase supply is obtained from two (ultimately three) 1,000-kva., oil-immersed, self-cooled, Scott-connected transformer banks supplied from the general 2,300-volt system and located outdoors under the 230-volt power room at one end of the turbine hall. Adjacent to the 230-volt power room is an emergency valve control room from which all main electrically operated valves can be closed.

MAJOR AUXILIARY MOTORS, RICHMOND STATION

Auxiliary	Motor Rating, Hp.	Type of Motor	Starting	Speed Control	Automatic Re-starting
Boiler feed pumps...	550	Wound-rotor	Secondary resistance Push button	10 per cent range 18 points automatic	Yes
Circulating pumps..	500	Squirrel-cage	Full voltage—Push button	.....	Yes
Air pumps.....	50	Squirrel-cage	Full voltage—Push button	.....	Yes
Condensate pumps	100	Squirrel-cage	Full voltage—Push button	.....	Yes
Generator ventilating fans.....	150	Squirrel-cage	Full voltage—Push button	.....	Yes
Forced-draft fans...	125	Wound-rotor	Secondary resistance—	50 per cent range	
			Controller	5 points	Yes
Induced-draft fans..	60	Wound-rotor	Secondary resistance—	50 per cent range	
			Controller	5 points	Yes
Stokers.....	15	D.c. shunt	Resistance	80 per cent range	No
			Controller	22 points	
Fire pump.....	200	Squirrel-cage	Compensator	.....	No
River water pumps	275	Squirrel-cage	Full voltage automatic from float switch	.....	Yes
Air compressors....	190	Synch.	Full voltage—Push button	.....	No
Stoker supply motor-generator sets....	290	Synch.	Full voltage—Push button	.....	No

The 250-volt direct-current system provided for the supply of stoker motors, emergency excitation, emergency lighting (automatic on failure of the alternating-current supply), miscellaneous power, etc., is fed by three 200-kw. motor-generator sets and a 156-cell storage battery. The other 250-volt direct-current system supplies power for operating oil circuit breakers, valve motors, indicating lamps, etc., and is fed by two 20-kw. motor-generator sets and two 120-cell storage batteries. This system is entirely separate from the stoker and emergency excitation system, although an emergency tie is provided between the two. Control circuits of main and selector oil circuit breakers are operated on separate parts of the control system.

A diagram of the auxiliary power system at Richmond is shown in Fig. 1, which also indicates a typical normal method of operation. It will be noted that the system is so sectionalized that failure of any transformer bank, bus section, etc., will result in interruption to a minimum number of auxiliaries and that such auxiliaries as may be affected can be either switched quickly to another source or replaced by duplicate units.

A list of the steam-driven auxiliaries is also included in Fig. 1. All of these auxiliaries are intended for stand-by service only.

Motors.—The accompanying table lists the major auxiliary motors at Richmond, with their rating, type, method of starting, method of speed control, etc.

In general, all alternating-current motors above approximately 50 hp. are supplied at 2,200 volts, three-phase, while those below are operated from the 220-volt, two-phase system. However, for special services, such as those required for cranes or in the screen house, motors as large as 80 hp. are supplied at 220 volts.

TESTS AT RICHMOND STATION

The following is a brief description of the generator and the circulating water pump motors installed in the Richmond station and of the tests run.

The auxiliary generator is rated at 3,333 kva., 0.6 power factor, three-phase, 60 cycles, 2,300 volts at 3,600 r.p.m. The leakage reactance is 5.6 per cent and the short-circuit ratio is about 1.7. No-load field current for 2,300 volts is 68 amp. The self-excited direct-connected exciter is rated at 33 kw., 250 volts and is a four-pole unit.

The 32-pole motors driving the circulating water pumps are rated at 500 hp., three-phase, 60 cycles and 2,200 volts. These motors have a starting torque equal to full-load torque, and a pull-out torque of 2.8 times full-load torque. The slip at full load is 3.3 per cent of synchronous speed. The pump has a calculated torque characteristic which varies approximately as the square of the speed down to 70 r.p.m. Below 50 r.p.m. the torque increases with decrease of speed. The calculated torque with the valve closed is 65 per cent of full-load torque at full speed.

Since the auxiliary generator was required to start three circulating pumps in succession and only two were available for the test, an equivalent load, consisting of two generator ventilating fans driven by 150-hp. squirrel-cage motors and two boiler draft fans driven by 125-hp. wound-rotor motors, was used. The two pumps used were duplicate units on one condenser. In making the tests the generator and the above-mentioned motors were isolated from the remainder of the station, so that complete tests could be made without affecting the operation of the plant. Two six-element oscillographs with 8-ft. films were used in obtaining records of the tests. Besides taking records of the auxiliary generator and exciter voltages and currents, one oscillograph element was connected to a special magneto, giving an indication of the speed of one pump at all times. The tests fall in four distinct groups.

Group I.—One circulating water pump motor was started with no-load excitation on the auxiliary generator. With the pump valve in the open and closed position tests were made with the generator under control of the vibrating type of regulator and also with fixed excitation.

Group II.—With the equivalent of one motor running and with the voltage adjusted to normal, a second motor was started with the generator under the control

of the automatic voltage regulator and also with fixed excitation. The pump valves were open for these and subsequent tests.

Group III.—With the equivalent of two motors running and with the voltage adjusted to normal, a third motor was started with the generator under the control of the automatic voltage regulator and also with fixed excitation.

Group IV.—With no-load excitation on the generator, the two ventilating fans, the two boiler draft fans and one circulating pump motor were started together, and after an interval a second circulating pump motor was started. These tests were made with the generator under control of the automatic voltage regulator and

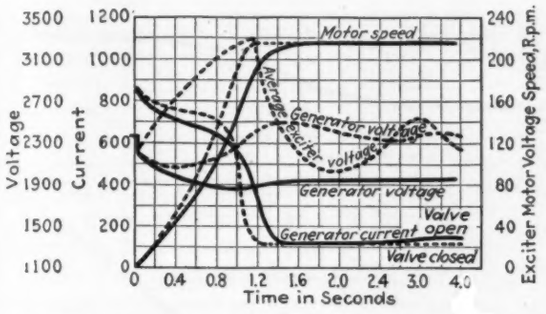


FIG. 2—CURVES SHOWING OPERATION OF THE CIRCULATING WATER PUMP MOTOR WHEN STARTED WITH NO-LOAD EXCITATION ON THE AUXILIARY GENERATOR

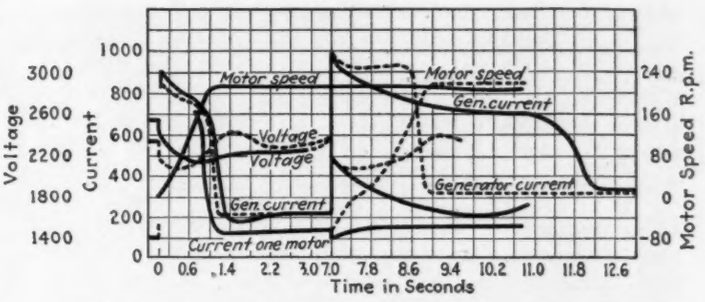
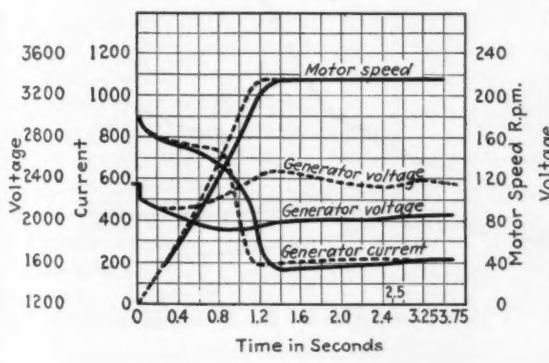


FIG. 4—SAME CONDITIONS AS IN FIG. 3, BUT WITH THE EQUIVALENT OF TWO MOTORS IN OPERATION WHEN A THIRD MOTOR WAS STARTED



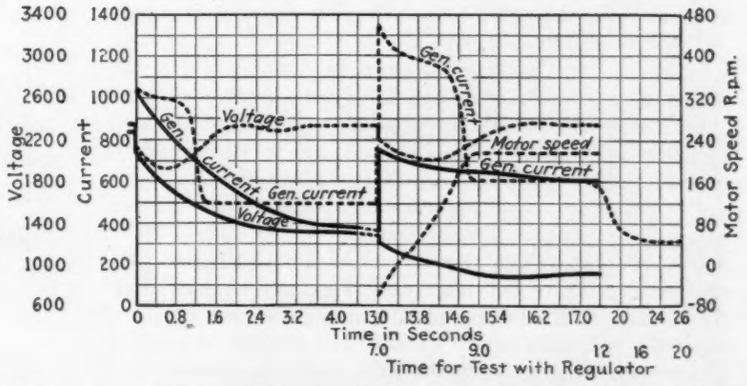


FIG. 3—VOLTAGE, CURRENT AND SPEED CHANGES. WITH THE EQUIVALENT OF ONE MOTOR RUNNING AND WITH THE VOLTAGE NORMAL, A SECOND MOTOR WAS THEN PLACED IN OPERATION, THE AUXILIARY GENERATOR BEING OPERATED UNDER VOLTAGE REGULATION AND WITH FIXED EXCITATION

FIG. 5—WITH NO-LOAD EXCITATION ON AUXILIARY GENERATOR, THE TWO VENTILATING FANS, THE TWO BOILER DRAFT FANS AND ONE CIRCULATING PUMP MOTOR WERE STARTED TOGETHER AND, AFTER AN INTERVAL, A SECOND CIRCULATING PUMP MOTOR WAS STARTED. AUTOMATIC REGULATION OF GENERATOR WITH FIXED EXCITATION

with fixed excitation. Several other miscellaneous tests were made.

The results of the tests under Group I are shown in Fig. 2. With fixed excitation, the voltage dropped from 2,350 volts to 1,850 volts in about one second and the motor accelerated to 67 per cent of synchronous speed. From this point up to full-load speed the impedance of the motor increased rapidly, so that the current decreased. Assuming that the motor impedance is constant and that the effect of reactance and armature reaction becomes effective instantly, a value of 1,400 volts is obtained with no-load excitation on the generator.

Whether pump valves are open or closed makes little difference in the time required to accelerate the motor to full speed. For either condition the current decreased to approximately 110 amp., gradually increasing to 140 amp. when the valve was open. The motor came up to full speed in both cases in 1.8 seconds with fixed excitation on the generator.

With the regulator in operation, a minimum of 2,060 volts was reached in 0.4 second. The regulator became effective very quickly, bringing the voltage back to normal in 1.1 seconds. In this case it took 1.4 seconds for the motor to come up to speed. The voltage was therefore normal before the motor reached full speed. The exciter terminal voltage built up from 110 to 220 volts in 1.1 seconds.

The results of the tests under Group II are shown in Fig. 3. Without the voltage regulator in operation, the voltage dropped to 1,920 volts in one second, and the motor reached full speed in 1.6 seconds. With the regulator in operation, the voltage dropped to 2,080 volts in 0.4 second and the motor was up to full speed in 1.4 seconds.

The results of the tests under Group III are shown in Fig. 4. Without the voltage regulator in operation, the voltage was adjusted to 2,540 volts on the generator with one motor running. The voltage dropped from 2,540 to 2,140 volts when the second motor was started, recovered to 2,350 volts, and finally reached a minimum of 1,600 volts when the third motor was started.

A record of the speed of the second motor was taken when the third motor was started. Although the voltage dropped considerably, the speed dropped gradually from 216 to 204 r.p.m. This drop in speed counteracted the voltage drop, so that the current taken by the motor increased only from 140 to 160 amp. The inertia of the load already on the generator undoubtedly

helped the conditions when the third motor was started. The tests show that the current taken by a motor actually decreases for a time, The effect of the inertia may be judged from two tests run. With the valve open and the condenser full of water, a test was made to see how long it would take the motor to stop. In four seconds the motor reversed, and at the end of nine seconds the motor reached a maximum speed of 160 r.p.m. in this direction, due to the water flowing out of the condenser. With the valve closed, it took about 40 seconds for the pump to stop.

With the voltage regulator in operation, the voltage dropped to 2,080 when the second motor was started. The voltage had been restored to 2,350 volts at the time of starting the third motor and dropped to 2,070 in 0.4 second, but was restored to normal in 1.7 seconds. In this case it took longer to bring the motor up to speed because it was running at 75 r.p.m. in a reverse direction when the voltage was applied. It took 0.6 second to stop the motor and a total of 2 seconds for the motor to reach full speed.

Effect of Fan and Pump Motors

The results of the tests under Group IV are shown in Fig. 5. Without the voltage regulator in operation the voltage dropped to 1,300 volts in thirteen seconds, and when the last circulating pump motor was started, the voltage dropped to 900 volts and remained there. The second pump was rotating in a reverse direction and the voltage was not high enough to produce sufficient torque to stop the pump before the test was discontinued.

Under regulator control the application of the first load caused the voltage to drop to 1,920 volts in 0.6 second and it was restored to 2,330 volts in two seconds. When the second load was applied, the voltage dropped to 2,000 volts in about one second and was restored to normal in 2.8 seconds. Again the pump was running at 70 r.p.m. in a reverse direction and it took a total of two seconds to start the motor.

The current, when the second load was applied, decreased rapidly to 600 amp. and remained at that value for a time, again falling to 315 amp. The second drop no doubt indicates where some of the high inertia fans, which were started with the first load, approached full speed operation.

In no case did the average speed of the turbine fall more than 3 per cent. Although the currents were comparatively large, the actual load was not excessive and came on gradually.

A test was made to determine the torque necessary to start the motor revolving. This was done by lowering the generator voltage and connecting the motor to the generator by closing the oil circuit breaker. It was found that with 750 volts on the generator the motor revolved slowly. Considering that the starting torque varies as the square of the applied voltage, this indicates that it took approximately 11 per cent of full-load torque to start the motor revolving. This test was made after the motor had been in operation for some time.

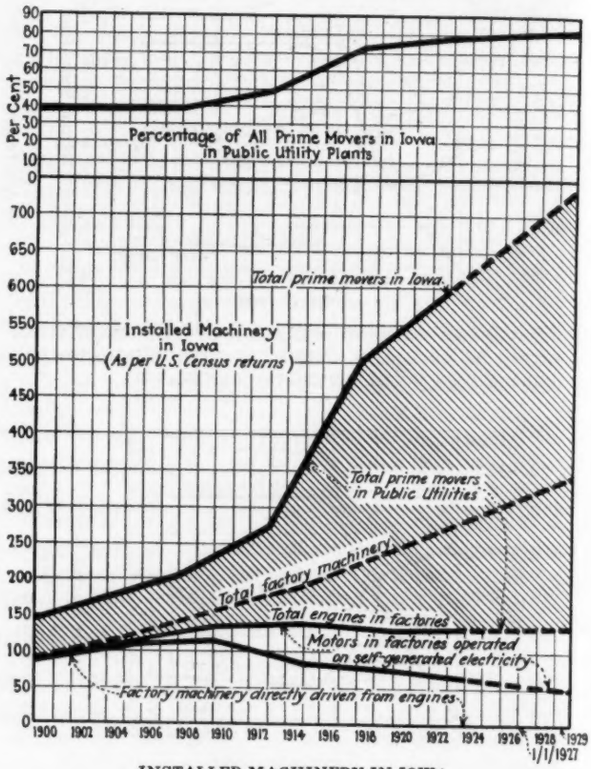
It is seen from these tests that the actual voltage conditions are much better than calculated, such calculations being based on steady state conditions, assuming an instantaneous decrease of generator flux and constant motor impedance. The tests also show conclusively that an automatic voltage regulator has a decided stabilizing effect.

Majority of Iowa's Industries Electrified

By Joe Carmichael
Director Iowa Committee on Public Utility Information

THE widespread extent to which industries in Iowa are applying electricity to their manufacturing operations, due to the state's vast power resources, is strikingly emphasized in an industrial survey that has been made of the state. This survey shows that nearly three-quarters, or 72.3 per cent, of the state's industries are electrified, compared with a nation-wide average of 66 per cent.

The accompanying chart shows the progress of the


Per Cent
Percentage of All Prime Movers in Iowa in Public Utility Plants
Total prime movers in Iowa
Installed Machinery in Iowa (As per U.S. Census returns)
Total prime movers in Public Utilities
Total factory machinery
Total engines in factories
Motors in factories operated on self-generated electricity
Factory machinery directly driven from engines
1/1/1927

INSTALLED MACHINERY IN IOWA

electrification of industry in Iowa since 1900. The total of prime movers, prime movers in public utilities and total factory machinery, showing motors operated by power purchased from electric plants and motors in factories operated on self-generated electricity and machinery directly driven from engines, is indicated. Curves are extended to forecast what the industrial electrification peak will be in 1929, provided the same rate of increase prevails.

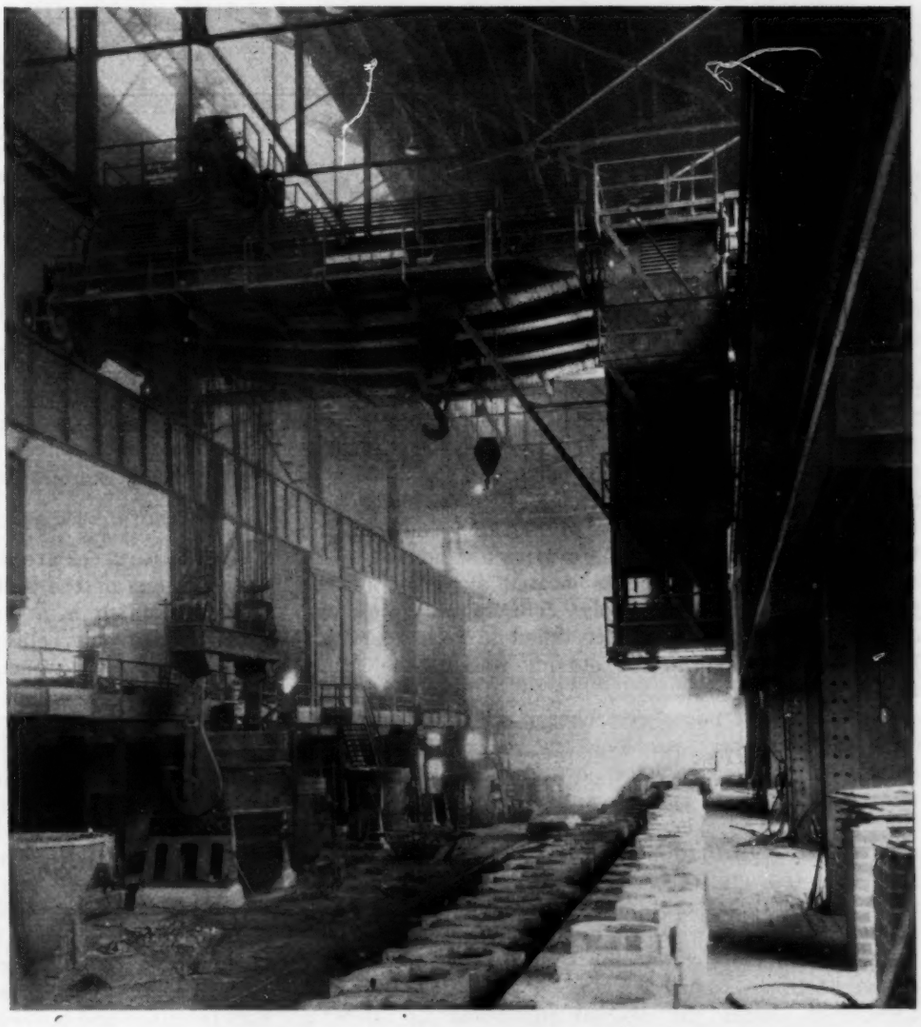
Iowa central stations furnish 58.7 per cent of all energy used by power consumers. The remainder is generated by industries in their own plants. An important phase of this definite trend toward industrial electrification is that 80 per cent of all prime moving machinery is employed by the state's public utility plants. Central stations added 700 power customers to their lines during 1926 alone. To meet this increasing demand the central stations have added 39 per cent to their generating equipment since 1922. In that year the installed capacity represented 236,036 kw. Smaller communities in Iowa are not handicapped in competing with the larger cities for industrial growth. Of the 922 cities and towns in Iowa, 882 have electric energy available.

An Extensively Electrified Steel Plant

Installation of Larger Electric Arc Furnaces and Use of All-Electric Charging Equipment, Cranes and Blooming Mill Increase Efficiency and Production—Roller Bearings Widely Used

By M. T. Lothrop
Vice-President Timken Roller Bearing Company, Canton, Ohio

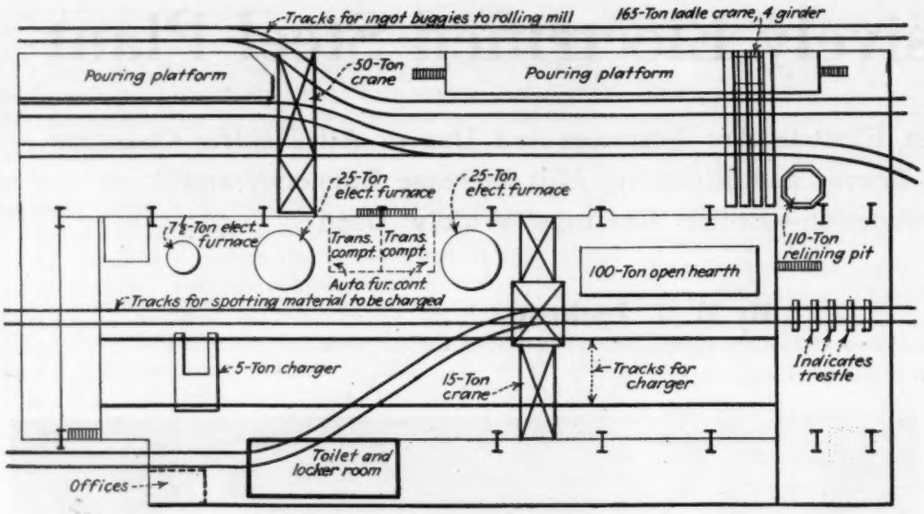
THE new steel plant recently put into operation by the Timken Roller Bearing Company at Canton, Ohio, for the purpose both of taking care of its own increased production and to answer the demand for high-grade steel that exists among other manufacturers offers a very interesting example, electrically and mechanically, of modern practice in the application of electric power to the production of steel. It may be considered one of the most completely electrified plants in existence, since not only the material is handled electrically but the major portion of the steel produced is obtained from electric arc furnaces. It is also believed to be the only plant in operation where the electric furnaces are charged by an open-hearth charging machine.



165-TON LADLE CRANE FROM THE POURING FLOOR

The steel plant consists of three buildings, one of which contains the furnaces, the material storage and charging facilities and the pouring and ladle-handling equipment, the second the soaking pits, rolling mill, shear and annealing pits, together with the apparatus for handling the ingots and blooms, the third being the stockhouse. The entire layout of the furnace building has been planned with the idea of increasing to the utmost the speed and convenience of all the operations connected with the production of the steel. The building is divided longitudinally into two sections, the charging floor and the pouring floor, each of which occupies about half the width of the building. The charging floor consists of a platform, raised about 17 ft. above the level of the pouring floor, on which are located the charger, which serves the open-hearth and electric furnaces; the transformers, which supply power to the electric furnaces; the material bins, and the offices.

The furnaces, which include two 25-ton and one 7-ton, three-phase electric arc and one 100-ton open-hearth furnaces, are supported on separate foundations, which bring them up to the level of the charging floor. This construction is shown in an accompanying illustration. Furthermore, all the furnaces are arranged in line, with their charging doors opening toward the same track, on which charging cars can be spotted. Thus they are all equally accessible to the charging machine. By virtue of these arrangements, slag pits for the furnaces are dispensed with. The motor-driven tilting mechanisms for the electric furnaces are located directly back of the individual furnace foundations, the control being



LAYOUT OF FURNACE BUILDING

on the platform above. Thus not only is the charging floor free from encumbrances and obstacles but the pouring floor is equally free, so that ladles can be moved quickly wherever desired, without requiring constant manipulation on the part of the crane operator to avoid other apparatus and equipment. Charging and pouring operations can be carried on without any delays.

Energy is supplied by the Ohio Power Company, and the power to operate the arc furnaces comes in at 22,000 volts. This is stepped down to operating voltage by two 7,500-kva., three-phase, water-cooled furnace transformers for the 25-ton furnaces and one 3,000-kva. transformer for the 7-ton furnace. The secondaries of the former have three taps, giving 180, 220 and 250 volts respectively. The transformers are housed in individual brick compartments located alongside of the particular furnace they supply. The automatic electric control for the furnaces is installed in recesses which have been provided in the outside wall of the transformer compartments.

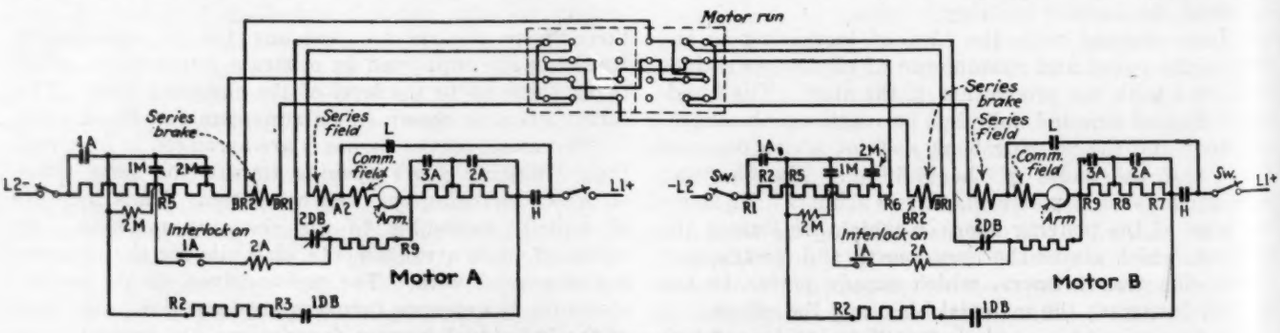
Electric arc furnaces were chosen, first, because their close automatic regulation and the absence of oxidizing agents in the furnace atmosphere insure the exact duplication, both as to analysis and general quality, of the steel produced by every heat; second, because the magnetic forces in the bath set up a continual motion, which insures a thorough mixing of the alloys and tends to force the lighter slag to the top, and, lastly, because of the rapidity with which heats can be accomplished, which is sufficient to permit the production of four or five heats per furnace per day of 24 hours. In order further to assure the desired quality of the steel, a modification has been made in the furnace construction whereby the metal when poured flows first from the bottom of the bath, and the slag is held back. This greatly reduces the possibility of slag inclusions and the mixture of other impurities in the ingots.

The three arc furnaces in this installation have displaced five smaller arc furnaces formerly used, with the result that considerable savings have been effected in production costs. Some of these savings are directly traceable to the reduction in over-all power consumption per ton, the comparison being as between approximately 550 kw.-hr. per ton for the new furnaces (with a maximum demand of approximately 19,500 kva.) and 685 kw.-hr. per ton for those formerly used.

The over-all radiation losses have also been reduced from about 250 kw.-hr. per ton to 150 kw.-hr. per ton. This last saving is attributable partly to the fact that there is less combined radiation surface in the three new furnaces than there was on the five old ones and partly to the improved construction of the new ones. The convenient arrangement of the building has also had considerable effect on the reduction of power and labor costs in connection with the auxiliary equipment.

ELECTRIC FURNACE-CHARGING EQUIPMENT

All the furnaces are served by a new type of charger, which is one of the features of the installation. This machine, which is a low, floor-type unit of 5-ton capacity, is not only believed to be the first of its kind to be equipped with worm gear drive but is the first to be supplied throughout with standard tapered roller bearings. The construction and operation of the machine are, briefly, as follows: The trolley frame and end casting are both solid one-piece castings, a construction that eliminates the necessity for mounting the driving motors and shafts on separate supports bolted to the frame, which are likely to work loose as a result of the severe racking and vibration to which the machine as a whole is subject and throw the assembly out of alignment. The charging ram is of forged steel, this material being more resistant to heat than cast steel and consequently having a longer life. The ram is raised and lowered by means of two crankshafts, which are driven by a 40-hp. motor through a worm



SIMPLIFIED DIAGRAM OF THE MAIN HOIST CONTROL OF THE LADLE CRANE

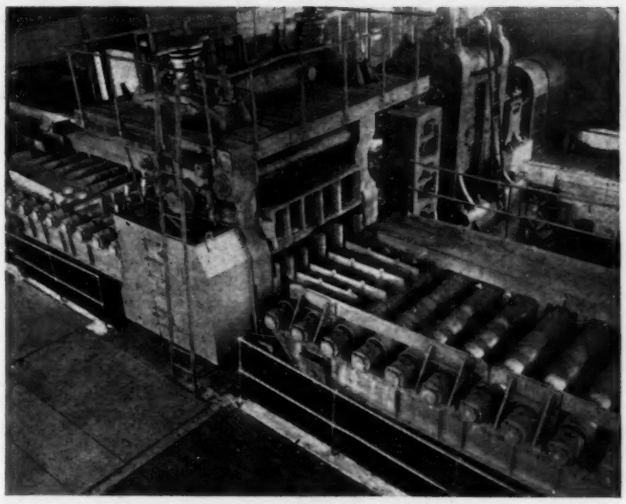
gear having a speed reduction ratio of 20 to 1. The shafts of both the worm and wheel respectively of the gear are equipped with three sets of tapered roller bearings, the two inboard bearings being of the single and the outboard, or pinion, bearing being of the double type. The ram is rotated by a 5-hp. motor, which drives it through a set of spur gears.

The ram cross-travel mechanism is driven through a worm gear by a 30-hp. motor located at right angles to the direction of travel. In this case also both the worm and wheel shafts of the train run on tapered roller bearings, the arrangement for both being the same as that for the hoist gear. Bridge travel is obtained by two 40-hp. motors, one on each side of the bridge, each of which drives its own set of track wheels through a geared line shaft. The shaft and all the wheels are completely equipped with tapered roller bearings. The entire control is of the magnetic time-limit variety.

Several striking advantages have been claimed for this machine, the more important of which are, briefly, as follows: In the first place, the substitution of worm for spur gears has rendered the machine much simpler and therefore easier both to operate and maintain. Secondly, both the number of moving parts and the friction load imposed by those actually incorporated in the machine have been greatly reduced, which has, in turn, made it possible to use motors of a lower horsepower, with a consequent saving in power consumption. Also, the combination of worm drive and the liberal use of roller bearings have minimized the lubrication expense, besides making the machine much easier running and thereby lengthening its useful life. Last, but not least, a construction has been permitted that gives the operator an unobstructed view of the end of the ram, the charge, the floor and the interior of the furnace.

165-Ton Ladle Crane

On the pouring side of the building is a 165-ton ladle crane, which is also the first of its type to be equipped with worm-gear drive and to have roller bearings throughout. The crane is of the four-girder type, and in addition to the 165-ton main hoist is equipped with a 50-ton auxiliary trolley and a 15-ton auxiliary hoist. A novel arrangement has been developed for the drive of the main hoist, which, in addition to simplifying its operation and construction, adds considerably to its safety features. The main hoist drive shaft consists of two sections of equal length butted together and connected by a flexible coupling. Each section has a 110-hp. driving motor at the far end, which is connected through a flexible coupling to a worm gear, which drives one of the hoisting drums through a pinion mounted on the shaft of the worm wheel. A solenoid brake is mounted on each section between the worm gear and the main coupling in the center. The effect, therefore, is that of a continuous shaft with a driving motor, gears and brakes at each end. The two hoisting drums are so located that their driving gears are parallel, and while under normal conditions they do not make con-



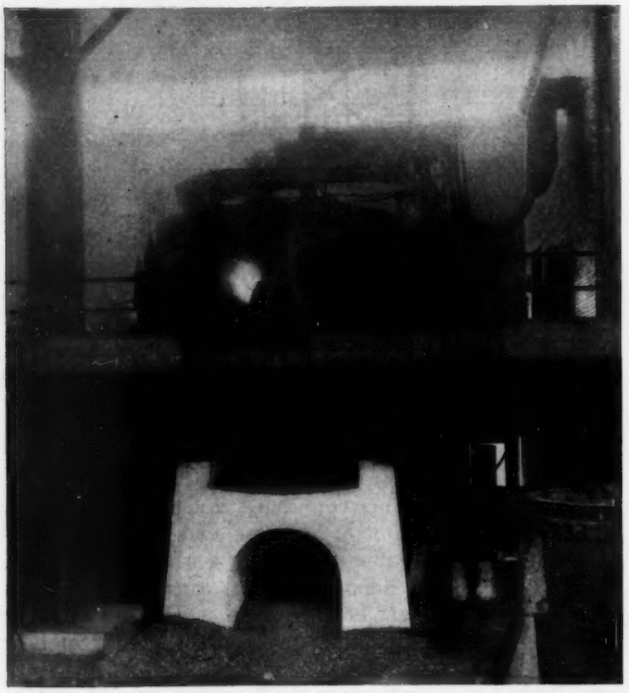
35-IN. BLOOMING MILL

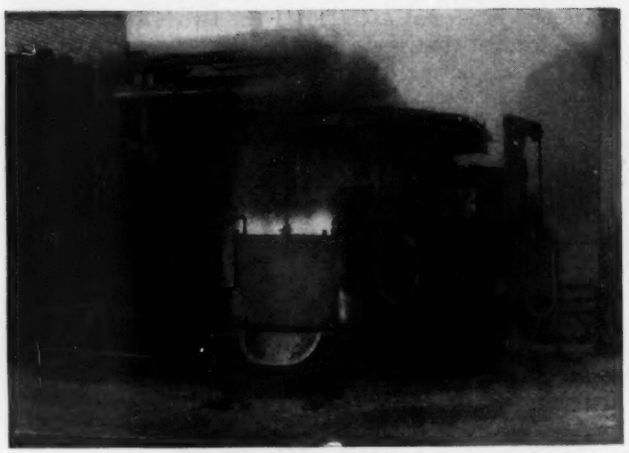
FIVE-TON WORM-DRIVEN CHARGER, SHOWING SOME OF THE METERS AND CONTROL

tact, in case of failure of a drum pinion, shaft or worm gear on either end of the main shaft they will make contact, so that the solenoid brake on the section of the shaft that is still operative can hold both drums stationary and prevent the load from dropping.

Crane Control Features

The control that has been developed for the main hoist drive also has some interesting features. It is of the magnetic time-delay type and consists essentially





ELECTRIC FURNACE IN OPERATION

The method of supporting the 25-ton furnace and the construction of the charging floor are indicated in the views of the installation shown above. The auxiliary equipment, controls and flexible leads from the transformer compartment to the furnace may be noted.

of two complete control systems, one for each motor, which are operated by a common master switch. The two are connected through the master switch so that their sequences in hoisting and lowering operate simultaneously and the motors are brought up to speed in perfect synchronism. Therefore there is no possibility of a twisting strain being applied to the main shaft owing to one motor exerting a different degree of torque or running at a different speed from the other. In case power on one motor fails for any reason, both are disconnected and the two solenoid brakes set, so that there is no tendency for one motor to try to drive the shaft against the brake of the motor that is out of commission. The control provides dynamic braking on both motors on both hoisting and lowering motions, which, in the case of the latter, is applied to reduce the motor speed before the solenoid brakes are set. A simplified diagram of the control is shown herewith.

The rest of the control, that for the bridge, trolley and auxiliary hoist motions, is of the standard magnetic time limit variety. In this case, as in that of the charger, the two elements of the worm gears are mounted on roller bearings, the arrangement being the same as that described on the charger. The rest of the drives on the crane are of the spur gear variety, the trolley being driven by a 40-hp. motor through two sets of gears, and the bridge travel mechanism by two 90-hp. motors. The bridge has double compensating trucks, with a total of eight wheels at each end, two of which are driving wheels. All the motors are completely equipped with tapered roller bearings, there being a total of 342 used.

The apparatus in the mill house consists of the 125-ton stripper crane, the 5-ton soaking pit charging crane, the 35-in. blooming mill, the shears having a 10x10-in. hot capacity, and a 20-ton crane for handling the billets in and out of the annealing pits. In this installation many of the roller-bearing installations represent the first ones ever made for their particular classes of service. These include those on the stripper crane, the tongs-turning shaft, stem thrust bearing, the tongs-turning lower sheave shaft, operating shaft and operating sector. The trolley wheels, main hoist, drum shaft, reduction shafts, sheave and motor back shaft extension are similarly equipped.

On the blooming mill, which is a three-high, 35-in. mill, with top and bottom roll screw down, driven by a 1,500-hp. induction motor, all the rolls of the mill-approach table and those of both lifting tables are equipped with tapered roller bearings. The side shafts of both the mill approach and lifting tables are similarly equipped. The same is true in the case of the shear approach and depressing table rollers and the approach and depressing table side shafts. The drive of the shear itself is of an unusual variety, the power for the stroke being entirely supplied by a 250-hp. motor, with no intermediary clutch and no flywheel. The motor runs only when a cut is to be made, instead of continuously, as is usually the case. Its control is actuated by a foot treadle on the shear frame.

Paris Adds Hydro Power

THE Société de l'Union d'Electricité of Paris is now augmenting its electricity supply in the Paris district by power transmitted from the Eguzon hydro-electric station, completed last year. The huge steam-operated station at Gennevilliers, near Paris, has now a capacity of 340,000 kw. Last year the electrical output of the Union company amounted to 749,000,000 kw.-hr., as against only 671,000,000 kw.-hr. in 1925. Part of the increase is explained by the fact that the Union company is now supplying energy for all the electrified lines of the Paris-Orleans railroad.

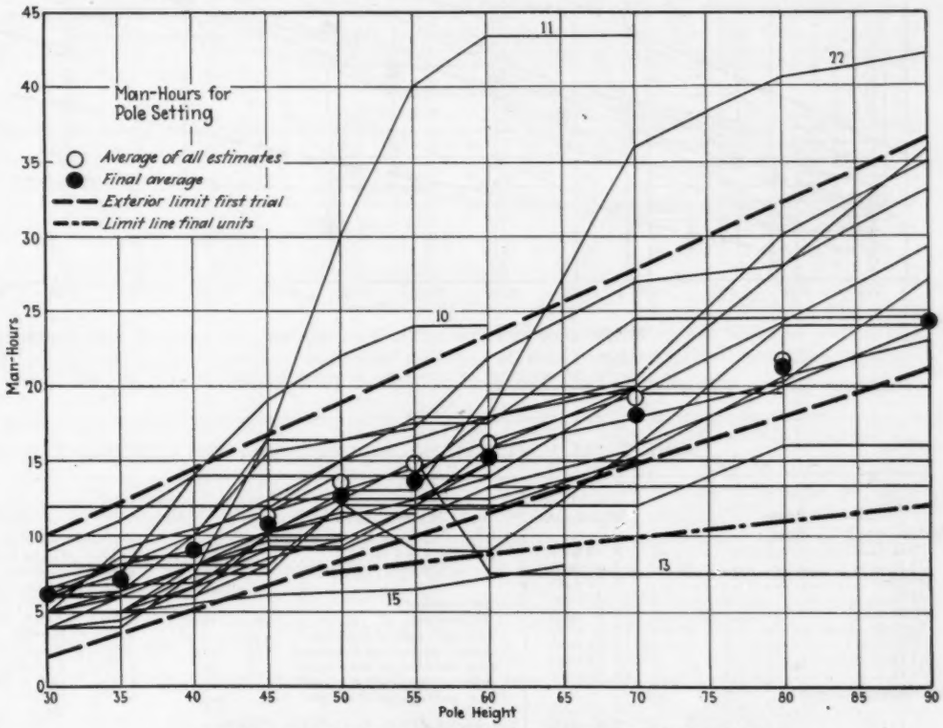
Man-Hours Used as Basis for Unit Labor Costs

Total Labor Costs Segregated into Units by Using Man-Hours Required for Each Item—Method of Derivation and Application Given

By W. G. Cross
Assistant Valuation Engineer Southern California Edison Company, Los Angeles, Cal.

THE difficulty in securing individual unit costs from accounting records lies in the fact that the required units are too small to have individual counting identity. Furthermore, the grouping of costs in work orders, jobs, etc., does not lend itself readily to the derivation of unit costs per pole, per crossarm, per insulator, per thousand feet of wire, etc., where the jobs include various items of construction, inasmuch as no division is afforded. If special jobs are taken that contain only one item of distribution construction, it is later found that the unit costs obtained from this type of job are not representative of average jobs.

The Southern California Edison Company has successfully used a method for several years that segregates the total labor cost incurred on a composite job into its component units. By means of a time-study method a set of fundamental units has been produced, which are not themselves of dollar magnitude, but which are expressed in man-hours for average type of work. By the percentage relationship between the man-hours for each item the total cost of a composite job is segregated into individual unit costs.

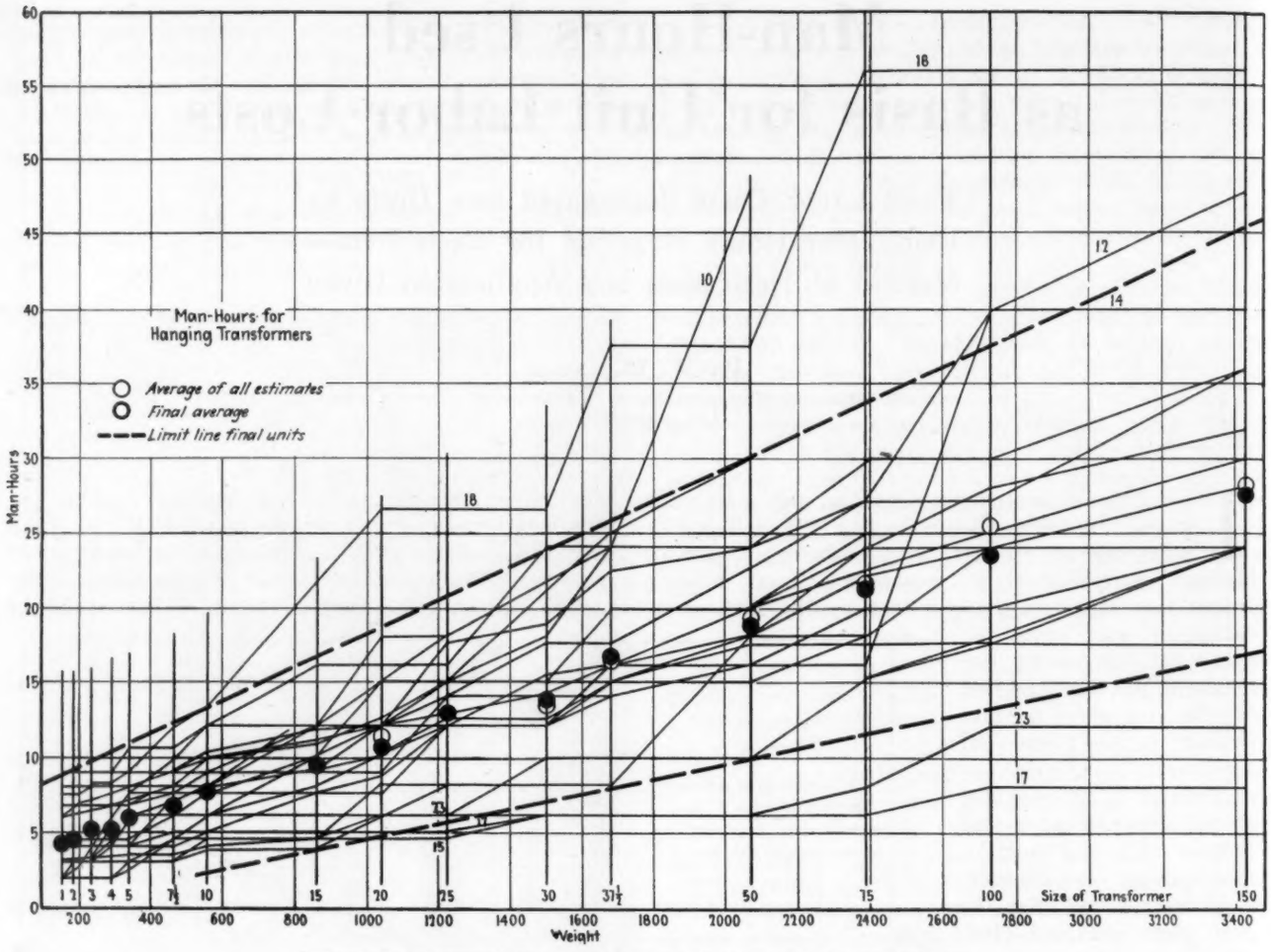


METHOD OF DETERMINING MAN-HOURS FOR SETTING POLES
Light full lines represent estimates from various districts. Limit lines were drawn and an average determined as indicated by the black dots.

The method involves determining the quantities of each item installed on any job, these being multiplied by the unit man-hours per item, and this in turn multiplied by the unit labor cost per man-hour, producing a trial labor cost for each item. The summation of these costs gives a total for the entire job which is comparable with the actual sustained cost of the entire job. If the theoretical man-hour units and labor rate were correct and if there were no lost time or traveling time involved, the trial total thus obtained would be equal to the actual labor cost of the work. Of course, this theoretical result is not attained in practice, because of the differences that have been suggested. The percentage relationship that obtains between the two totals forms a measuring stick or criterion by means of which the costs of single jobs or series of jobs may be compared with others, whether they are performed by various construction organizations perhaps, in various localities, or the like. The relationship between these percentage factors, commonly termed "rectification factors," is the measure of comparative cost of doing the work.

Basis of Method

To explain this method a little more fully, it will be assumed that a fundamental list of man-hour units for each item of distribution system construction is available and that it is intended to apply it to a job the total labor cost of which was $143.75, the labor wage rate for the distribution gang used averaging 72 cents per hour. The records are consulted to find the qualities of



METHOD OF DETERMINING MAN-HOURS FOR HANGING TRANSFORMERS

Light full lines represent estimates from various districts. Limit lines were drawn and an average determined as indicated by the black dots.

SOME TRIAL UNIT MAN-HOURS REQUIRED FOR DIFFERENT OPERATIONS

Material Item	Trial Unit Man-hours
Poles—wood (by hand):	
30 ft	6.12 each
35 ft	7.05 each
40 ft	8.88 each
45 ft	11.25 each
50 ft	12.97 each
55 ft	13.57 each
60 ft	15.07 each
65 ft	16.75 each
70 ft	18.10 each
Crossarms—single:	
A	1.13 each
C	0.85 each
D	0.77 each
G-H or 13	0.61 each
J-K or 14	0.65 each
L	0.76 each
Crossarms—double	
A	2.34 each
C	1.79 each
D	1.40 each
G-H or 13	1.28 each
J-K or 14	1.39 each
L	1.68 each
Guy guards	0.25 each
Pole-top extension	2.80 each
Pole steps	0.11 each
Grounds	2.91 each
Ground cover	1.00 per 1 00 ft
Pierce brackets, 111	0.31 each
Pierce brackets, 237	0.42 each
Meter or voltmeter box	1.70 each
Transformer platform	22.85 each
Lightning arrester—2,200-volt single unit	1.48 each
Lightning arrester—10-kv. horn gap unit	3.78 each
Anchor plate (by hand):	
10 in	2.07
15 in	2.33
20 in	2.86

Material Item	Trial Unit Man-hours
Anchor Plate (by hand), continued:	
Everstick—4 W	1.41
Never Creep	1.41
Guys—anchor:	
No. 6 solid	0.91
¼-in. galvanized standard	1.09
5/16-in. galvanized standard	1.28
⅜-in. galvanized standard	1.45
7/16-in. galvanized standard	1.66
½-in. galvanized standard	2.18
Guys—head:	
No. 6 solid	1.35
¼-in. galvanized standard	1.42
5/16-in. galvanized standard	1.75
⅜-in. galvanized standard	2.00
7/16-in. galvanized standard	2.15
Weatherproof wire:	
500,000 circ.mil standard	41.85 per 1,000 ft.
350,000 circ.mil standard	26.16 per 1,000 ft.
4/0 standard	23.50 per 1,000 ft.
3/0 standard	22.92 per 1,000 ft.
2/0 standard	22.40 per 1,000 ft.
1/0 standard	20.02 per 1,000 ft.
1 standard	16.36 per 1,000 ft.
2 standard	13.60 per 1,000 ft.
4 solid	11.65 per 1,000 ft.
5 solid	10.50 per 1,000 ft.
6 solid	9.53 per 1,000 ft.
8 solid	7.70 per 1,000 ft
10 solid	6.90 per 1,000 ft.
Bare copper wire:	
4/0 standard	21.20 per 1,000 ft
2/0 standard	19.08 per 1,000 ft.
1/0 standard	13.42 per 1,000 ft.
2 standard	13.26 per 1,000 ft.
4 solid	11.60 per 1,000 ft.
6 solid	9.62 per 1,000 ft.

Material Item	Trial Unit Man-hours
Insulators:	
Glass D.P.D.G., No. 7760	0.07 each
Porcelain D.P.D.G. No. 3437	0.08 each
11-kv. pin type 4 in. No. 9406 OB	0.16 each
11-kv. pin type 7-in. Redlands	0.20 each
15-kv. pin type, Thomas No. 2021	0.17 each
Knobs	0.12 each
Hook or screw knobs, No. 2925	0.15 each
Sweeney loop	0.26 each
Goose egg strain, small	0.17 each
Large strain bob, No. 237021	0.30 each
Small strain insulators, Thomas No. 1074	0.25 each
Disk strain, Hewlett 7½ in	0.30 each
10-in. disk suspension	0.40 unit
Transformers—2,200 volt single phase:	
1	3.93 each
2	4.24 each
3	4.86 each
5	5.68 each
7.5	6.55 each
10	7.34 each
15	8.95 each
20	10.30 each
25	12.65 each
30	13.25 each
37.5	16.18 each
50	18.48 each
75	21.10 each
100	23.00 each
Switches:	
Baum F. H., No. 1013	1.48 each
Baum switch, No. 413	13.60 each
Kelman pole-top oil switch 10,000 volts	11.35 each
Kelman pole-top oil switch 15,000 volts	25.40 each
P. E. No. 1417 or No. 1427	11.35 each
R.E.C. (set of three)	13.60 each
Time switch	4.02 each

material that were installed, and the man-hour units and unit wage rate per hour are applied to these quantities somewhat as follows:

Item	Man-hour Unit	Average Wage Rate per Hour	Extension
Two 45-ft. poles	11.25 each	$0.72	$16.20
Four 40-ft. poles	8.88 each	0.72	25.56
One 35-ft. pole	7.05 each	0.72	5.08
Eight 10-ft. crossarms	0.76 each	0.72	4.40
Two anchor guys	3.61 each	0.72	5.20
7,500-ft. No. 6 T.B.W.P. wire	9.53 thousand feet	0.72	51.45
26 D.O.D.P. insulators	0.07 each	0.72	1.30
One 5-kw. transformer	5.68 each	0.72	4.09
Trial total cost			$113.28

Inasmuch as the actual cost of this work was $143.75, the relationship between the two, or the rectification factor, is $143.75 ÷ $113.28 = $1.27.

This indicates that the cost of doing the work exceeded the theoretical amount by 27 per cent, which may have been due not only to traveling time and similar costs but also to difficult construction conditions existing on the job. By rectifying the costs of each item entering into the trial total of $113.28 by the factor of 1.27, it is evident that costs for each of the individual items is thus obtained, the sum of which will again equal the actual labor total of $143.75.

The set of man-hour units used in making this segregation is, of course, the fundamental factor. The method of obtaining this set of trial units is rather interesting and is here described. There are 25 operating districts in the Southern California Edison Company, in each of which distribution system construction is under the supervision of a district foreman. In general, each man has been with the company for many years. All are thoroughly familiar with this type of work and make estimates of the costs of individual jobs when requesting authorization for the work. In the latter, however, it is found that the mental process involved is that of estimating the length of time required and the number of men to do the work, eventually extending this mental picture of man-hours by an average labor wage rate.

Each district foreman, therefore, received a list of all items entering into distribution construction for which it was later desired to obtain unit costs and was asked for his estimate of the number of men and number of hours that would be required to install each type of item under average working conditions and for an average type of job. The responses were then reduced to a man-hour basis for each unit by multiplying the number of hours by the number of men indicated to do the work. In comparison, the 25 various estimates for each unit were found to agree very closely, although in each case there were two or three estimates differing widely from the rest, about eight or ten lying some distance from the average and the remainder being almost identical. Curves, two of which are reproduced herewith, were plotted for such items as poles, wire and transformers, showing a very consistent grouping of estimates about the average. Limits were drawn, represented in the diagram by the dashed lines, which excluded such estimates as were considered out of reason and classed those remaining as reasonable. The latter were averaged mathematically and produced the average estimate of individual man-hours required to install each item entering into distribution construction. The results of this process give a table, a part of which is herewith reproduced.

Requests to the district foremen included also estimates of time required for removal of the various items, and these estimates were tabulated in a manner similar to those for installation. With such removal man-hours, it then becomes possible to analyze the labor costs of jobs that include not only straight construction but also reconstruction and removal.

Segregation of the total labor costs of jobs by these proportional man-hour units has proved extremely satisfactory in cost analysis, but it is found that this is true only when the number or size of jobs is sufficiently large to afford a representative amount of work, as individual jobs will be found to vary extremely from the average. Proof of the correct proportioning of units in the table given is afforded by the fact that analyses of jobs containing much more of one type of construction than another produce rectification factors agreeing very closely with those for average jobs of the ordinary type of construction.

A further use for the results of studies involving these standard man-hour trial units lies in the determination of rectification factors covering calendar periods for various districts and organizations.

It is not suggested that the units here given would be strictly correct for all systems, owing to differences in the standards of construction employed by various companies, but it is believed that they will be found very close in most cases.

High-Powered Electric Locomotive on the C., M. & St. P.

This 110-ton storage battery locomotive is used by the Chicago, Milwaukee & St. Paul Railway for switching service. It is capable of handling a 60-car freight train at 10 m.p.h.

Customers Buy 490,000 Shares

Public Service of New Jersey Completes Tenth Successful Customer-Ownership Campaign—Sales Average 4.3 Shares Per Subscriber

BY EDWIN H. ROBNETT
Campaign Manager Public Service Corporation of New Jersey

WHAT proportion of the purchase price of stocks that are sold by power and light companies directly to customers should be paid for in cash? What should be the period allowed for balance payments? These and a myriad of similar problems present themselves to every public service company which sells stock direct to customers. The experiences of Public Service Corporation of New Jersey, of which the Public Service Electric & Gas Company is a subsidiary and the preferred stock of which has been sold to customers of the latter, in its tenth public ownership campaign may therefore be of interest to others who are conducting or who contemplate similar campaigns.

During the ten completed campaigns the Public Service Corporation of New Jersey marketed stock aggregating 490,946 shares net after deducting 28,199 cancellations, which amount to about 5.5 per cent of total subscriptions. Sales averaged 4.3 shares per subscriber. In May, 1921, just prior to our first campaign, we had a total of 2,763 stockholders, and in May, 1927, there were more than 62,450. During the first two campaigns the stock sold was 8 per cent cumulative preferred. during the next four 7 per cent cumulative preferred, and the last four 6 per cent cumulative preferred. In all the campaigns the stock was sold at par of $100 and accrued dividends, either for cash or on the installment plan.

EARLY POLICY CHANGED

During the early campaigns the installment plan called for the payment of $10 per month for each share subscribed for. In the fifth campaign terms were changed to $5 down and $5 per month per share, with the idea in mind that a larger number of prospective purchasers could be reached, including many who could not afford to set aside as much as $10 a month. Although this was to a certain extent true, the field for stock sales was not materially increased; and as the time in which payments could be made was spread out over a period of approximately nineteen months, more people were inclined to cancel their subscriptions than when the time of payment covered only half that period. In the subsequent campaigns, therefore, it was decided to go back to the original plan of $10 down and $10 per month per share. In the event of a purchaser finding it difficult to complete his purchase or desiring to withdraw before such completion, the corporation will dispose of the stock for him upon written request. In actual practice the company usually refunds to the purchaser the total amount of his installment payments together with interest up to the date of cancellation. As an incentive to employees a bonus of $2 per share is paid. In addition, the company offers special prizes each month for the various divisions and for the system as a whole.

The officers in charge of the first five campaigns were the vice-president in charge of finance and the new-business agent, who acted as campaign manager. A field assistant was appointed to follow up and assist the division and district stock committees in their work of organizing and approving the various schemes under their direction. Just prior to the sixth campaign the Public Service Stock & Bond Company was formed (Feb. 1, 1925). The direction of campaigns is now under the supervision of the vice-president in charge of operation of this organization, with the officer who formerly acted as field assistant to the new-business agent as campaign manager. There is a general stock sales committee, of which the vice-president in charge of operation of the Public Service Stock & Bond Company is chairman.

BULLETINS AND REPORTS

Reports of the sales made the previous day are telephoned in each morning by all department heads to the office of the campaign manager. These reports are then compiled for the entire territory and a daily bulletin issued which shows a tabulation by districts and by departments of the subscriptions received, number of shares sold, and with new sales suggestions given in the footnotes.

Similar bulletins are prepared each day by each of the six operating divisions. These division bulletins cover the results of the sales in the division only and the material contained in them is given a more personal touch as concerns individual employees than can be given in the state bulletin. Some of these division bulletins also contain some amusing cartoons drawn by the company's employees.

Weekly bulletins showing the bogey, amount of stock sold and percentage to bogey of every district office of each company, division, operating and commercial department are also sent out by the office of the campaign manager.

Sales of stock are made entirely by the employees of Public Service organization and not by special agents. The Public Service Stock & Bond Company has a force of men that sells securities of the corporation and its subsidiaries the year around, but sales made by this company are not counted in the campaign results.

House-to-house canvassing is carried on by our commercial sales representatives in connection with their regular work and by other employees after working hours. Telephone calls are made to a selected list of customers. A circular letter is sent to selected lists of customers, and letters are followed in a few days by personal calls. In the offices a special display of literature and advertising matter is maintained and a salesman is assigned to receive and interest prospective stock customers who may come into the offices. When closing a sale with a customer, the employee tries to obtain names of his friends or of others whom the customer thinks might be interested. An employee who speaks the language is sent into the Polish, Italian or other foreign settlements to interest the leaders in these settlements, to endeavor to sell them and secure their help in explaining the proposition to others.

Public Service stock campaigns usually cover a period of two to two and one-half months. The most successful campaigns from a point of time and cost were the first offer of 7 per cent, when the allotment was sold in ten actual selling days—16,713 subscribers, 66,609 shares, and the fourth offer of 6 per cent, when 62,082 shares were sold to 12,457 subscribers in seven actual selling days. Employees are thoroughly posted regarding the company's activities and are able to answer intelligently any general inquiries made by our customers

regarding outstanding securities, financial position, growth of the business, etc. Incidentally, these stock sales have been a wonderful factor in the education of the employees regarding the company's affairs and have helped greatly in building up the morale of the entire organization. From the public relations standpoint the publicity and advertising that have been carried on have been the means not only of interesting a large number of our customers in investing in our securities but have shown them what public service stands for and how the success of the utility company is necessary for the proper development of the territory in which it operates.

In addition to the regular public campaigns we have conducted three campaigns for the sale of stock to employees, the sales being about two weeks in duration. The stock was sold to employees at par and an employee was permitted to subscribe to one or more shares in the proportion of one share for each $300 of annual pay received, but in no case for more than 50 shares. A payment plan of $3 per month was used in the first campaign and $5 per month in the second and third campaigns, payments being deducted by the company from the employees' pay as they became due. In the last employees' campaign we sold 10,537 employees 18,511 shares. During this campaign 57 per cent of the employees purchased stock and, taking into consideration the number of employees already stockholders and others who are still paying for stock from other campaigns, the number of employee stockholders will, when payments are completed, amount to more than 80 per cent of the total.

Conclusions Based on Experience

The experience acquired in these various campaigns has established certain underlying principles. The principal elements which enter into the successful operation of a stock campaign are:

1. Proper organization.
2. Education of employees as to company's affairs.
3. Education of the public by good newspaper and circular copy.
4. Confidence of the employee in the company he is working for.
5. Persistent work and a large number of calls per day by the employee.
6. A liberal policy by the company on bonuses to the employees.
7. Enthusiasm and interest taken in the campaign by the general managers and supervisory heads of the various departments. This is a most important factor, as we have found that the success of the sales work in the local districts and departments depends to a very large extent on the amount of enthusiasm and example set by the local department heads.

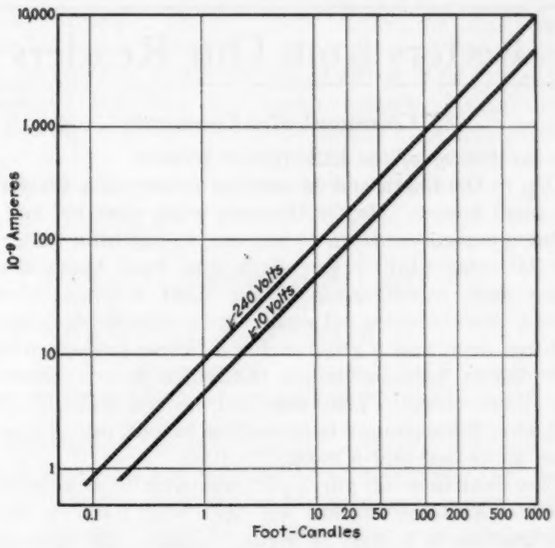
Germany Has 585 Miles of Main-Line Rail Electrification

UP TO the end of 1926, 585 miles of main-line railroads and 70 miles of suburban lines had been electrified in Germany. Of the main lines 275 miles are in Bavaria, and of the suburban lines 50 miles are in the Berlin area. At the present time 190 miles of line are in course of electrification, including the Konigszell-Breslau mountain railway (30 miles), the Munich-Rosenheim-Kufstein line (62 miles) and about 100 miles of the Berlin city and local railways.

Photo-Electric Cell Passes Exacting Fatigue Tests

Experiments Indicate Wide Range of Working Intensities and Voltages Without Impairment of Accuracy of New Type Light Unit

A NEW photo-cell which is being made by an entirely different process from that usually employed in the manufacture of these cells possesses performance characteristics of unusual interest. The bulb, containing only a small tungsten filament, is evacuated for hours at a high temperature with mercury diffusion pumps and liquid air traps. The tube is then sealed off. It resembles an ordinary electric lamp bulb. The photo-electric metal is introduced into this highly evacuated bulb by a special process of electrolysis



RELATION OF LIGHT INTENSITY TO CURRENT OBTAINED IN A PHOTO-ELECTRIC CELL

directly through the glass wall of the bulb. The result is a silvery coat of the purest photo-electric material.

The accompanying graph gives the relation between light and current passage through the cell. The cells are seen to be accurately linear over a range of 12,000-fold change in light intensity. The color sensitivity of the cell is like that of an orthochromatic photographic plate. Photo-electric fatigue is probably the most serious fault with any photo-electric cell and is by far the hardest fault to eliminate. In a severe case this fatigue may cause a photo-cell to give smaller and smaller currents as it is illuminated over a period of time by the same light. A photo-cell having mild fatigue gives a smaller current, than initially, for a given intensity of light after a brilliant light has been used. In this cell, known as the Burt cell, high sensitivity has been obtained through the purity of the surface and not by the introduction of gases to activate the surface. Activation is likely to be altered by the photochemical action of bright light on the sensitive surfaces, resulting in fatigue. This activation often spontaneously changes from day to day, thus causing the sensitivity of the cell to change.

A fatigue test to which Burt cells were subjected consisted of placing a cell in a dark box for several hours, then illuminating it by a single flashlight bulb without

lens or mirror at 1 m. distance, and taking a voltage-current curve. After an hour's illumination by a 150-watt lamp at about 8 cm. a voltage-current curve was again taken with only the flashlight bulb for illumination. The result was complete agreement with the original curve prepared. The same cell was then placed on a roof and high voltage applied in direct sunlight for two days. A third current curve taken with the same flashlight bulb was identical with the first two. A number of the cells were tested day after day and were found to give absolute reproduction at each voltage and intensity of light.

Since the cell works by a pure electron discharge, there can be no question of the quickness of its response. In all probability its speed is limited only by the capacity and inductance of the tube to short wave radio frequencies. The cells are used regularly up to the limit of audible frequencies.

Letters from Our Readers

Comment of a Consumer

To the Editor of the ELECTRICAL WORLD:

Up in the north end of our town there is a scattering of small houses. Mostly the men work near by, and the women come downtown to buy and to pay bills, generally on Saturday night. For some time back these women have been complaining at the light company's office about their service. I think it is something about a voltage drop and a request for a larger transformer to give better light—although the ladies do not commonly use these terms. This may not be the difficulty, but, anyway, the manager is intending to look into it just as soon as he can find a moment's time.

The manager of our light company is a wonderful mixer. Although he has not been with us long, we all say that he is a man of gifts. Usually the date for a banquet is not fixed until it is certain that the manager of the light company can act as toastmaster. There was some talk of printing in our paper his speech to our Rotary Club on "The Dignity of Service." It is our own Bishop, no less, who says that the manager's rendition of the burial service for the Order of the Iron Jaw is "most impressive, sir, most impressive." We think it is a marvel that he can do all these things and also run the light company property.

Some of these days those people up in the north end are going to file a petition with the Public Service Commission. This petition will be quite plain, not to say severe, in its architecture, demanding better service, complaining of long delays and omitting any reference to the popularity of the manager. They will have a dehydrated, leathery lawyer who does not belong to the Rotary Club and who has never joined the Order of the Iron Jaw. When the hearing is over the manager will write to the home office, very truthfully, that no matter how hard you try to keep people happy and make the company popular, there will always be some disagreeable persons who make trouble. I do not see how much can be done about this, unless the light company could get a manager who is a wonderful mixer and a plant which will run quite automatically.

WARREN R. VOORHIS.

[Location is purposely omitted as intent of letter is merely to indicate what gives the public its opinion of an organization—EDITOR.]

Responsibility for High Selling Costs

To the Editor of the ELECTRICAL WORLD:

Under the caption, "Buyers Prefer Amusing Salesmen," your issue of April 23 carries a letter from Vice-President Lincoln of the Lincoln Electric Company, Cleveland, that is worthy of more than passing notice. The statements he makes regarding the present-day sales costs are astounding, and the reason he assigns for this condition is amazing. I have long been aware that selling costs were abnormally high, but attributed it to the high pressure salesmanship and tremendously expensive advertising that have been the outgrowth of keen competition.

Mr. Lincoln's hypothesis throws a flood of light on a serious situation if only half of what he says is true, and there is probably some truth in it. If the buyers are responsible for the conditions he describes it is high time they were made aware of the facts and compelled to change their attitude. But are the buyers wholly at fault? In a buying experience of more than 30 years I have seen some radical changes in the methods of financing, producing and selling most articles of commerce. The type of salesman who was capable of imparting valuable information concerning the processes of manufacture, who was keenly alive to the intrinsic merits of his goods, who could arouse the interest of the buyer in the technical side of his business and who was vested with a measure of authority to conclude the terms of a bargain, has been largely displaced by a collector of orders who mechanically repeats some studied phrases but is incompetent to discuss vital details pertaining to methods of production and who substitutes a smutty story, or an offer of amusement, for a reasonable explanation of important facts, or a discussion of any other terms than those dictated by a distant and impersonal authority.

For totally different reasons from those deduced by Mr. Lincoln, I have sometimes declined to buy the product of certain manufacturers at any price, and no amount of proffered amusement would have altered my decision and, while salesmanship was not in question, in such cases the selling costs were undoubtedly increased.

That there are incompetent buyers as well as incompetent salesmen goes without saying, but, as salesmen far exceed buyers in number, the percentage of competency is probably in favor of the latter. While I agree most heartily with Mr. Lincoln that the condition he describes needs correction, in the interest of both the buyer and the seller, and am willing to split the blame for high selling costs with him fifty-fifty, I believe the remedy lies as much in the hands of the manufacturers as in those of the consumers. In any case, it is a vice to be deplored and rectified. GEORGE G. YEOMANS.

Pasadena, Cal.

New Italian Hydro Plant

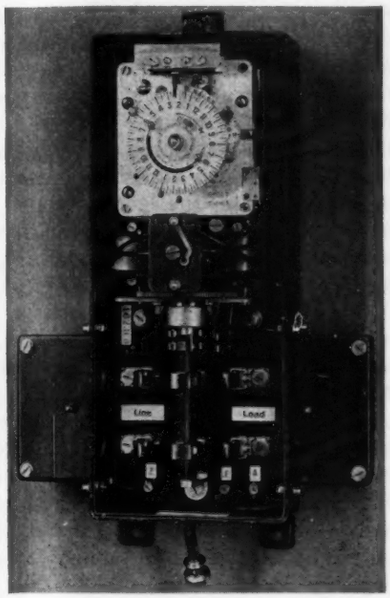
ONE of the most powerful hydro-electric plants in Italy was placed in operation a few days ago at Mese, near Chiavenna, by the Cisalpine Electric Company. A dam has been built at Prestone, on the Liro, the point of the higest fall, and the water is conducted to the central station at Mese, which is fitted with giant turbines of the Pelton type. High-tension transmission lines convey the electric energy to Brugherio, near Milan; to Bologna and to Arquata Scrivia. The regions benefited are Lombardy, Liguria and Emilia.

Central Station and Industrial Practice

Control for St. Louis Street Lighting

By J. E. Hillemeyer
Union Electric Light & Power Company, St. Louis, Mo.

THE starting impulse which closes the main circuit breaker and all switches for the primary street-lighting circuits in each automatic substation in the city of St. Louis is



STREET-LIGHTING CONTROL SWITCH USED IN ST. LOUIS

obtained from a Sauter time switch, which is self-wound and electrically operated. The clock movement of this switch is of the escapement type with an invar-steel balance wheel; it is ruggedly constructed and fully jeweled. The four-day main spring is wound with each operation of the switch and is thus always kept under constant tension to insure uniform pressure on the escapement. The motor is of the series type, 115/230 volts, and will operate on any commercial frequency or direct current without adjustment. Its power consumption is 20 watts during its period of operation, which will average not more than one minute per day. The contacts are of the drum type.

The operation sequences of this switch are as follows: In the evening the "on" operating pin throws a small toggle switch located at the top of the clock movement. This puts line voltage on the motor, which in running winds the clock mainspring and the contact-operating spring. When the clock mainspring is fully wound, the winding shaft is disengaged by a positive clutch arrangement, and when the contact operating spring has the proper amount of energy stored in it, the contacts are released and closed. By means of auxiliary contacts on the main contact shaft the power to the motor is shut off. In the morning or at the next switching time the "off" control pin throws the toggle switch to the opposite position and the operation is repeated except that the contacts open.

This time switch is equipped with an "astronomic" dial which uses no clock hands. A small pin located behind the time pointer at the top of the dial moves the star wheel on the periphery of the dial one tooth. Through a worm and pinion gear arrangement this causes the "on" and "off" arms to move slightly, which retards or advances the operating times of the switch following the schedule of street lighting each day.

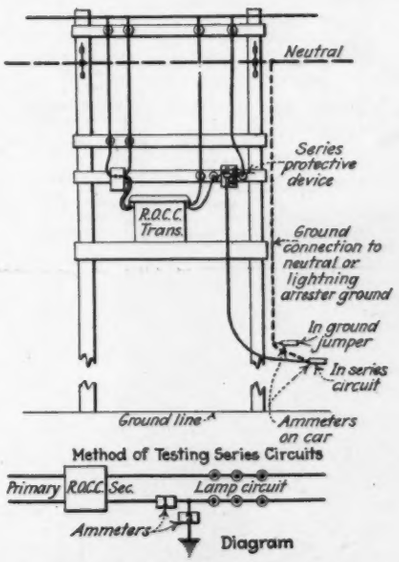
It is impossible to get the switch "out of step" with the lighting schedules. Even though the lights be tripped on or off by hand (throwing the toggle switch) ahead of schedule, their functioning at regular times will in no way be affected, according to experience so far.

Testing Current and Load on Series Lighting Circuits

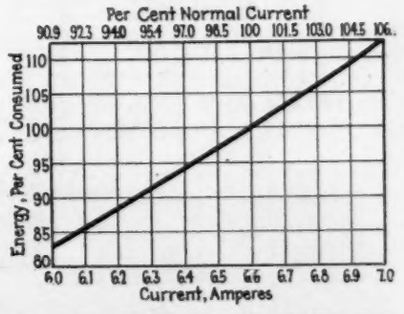
By T. A. Robinson
Assistant Electrical Engineer Northern States Power Company, St. Paul, Minn.

ST. PAUL, MINN., is illuminated chiefly by series lighting circuits, energized primarily by constant-current transformers, which are generally situated in the district they serve. To be sure that all lamps are receiving their rated current, the following test facilities and testing procedure are used:

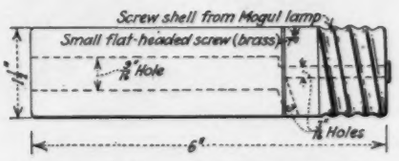
Series lighting transformer protective devices (General Electric) are mounted on all platforms and cut into the series lighting circuit. The film-cutout holders are not equipped with the insulating films, but are plugged into the device, nevertheless, in order to protect the contacts from the weather. Special ammeter leads are used. At one end of each is a wooden plug with the screw shell



METHOD OF TESTING SERIES CIRCUITS



VARIATION IN ENERGY CONSUMED WITH DIFFERENT CURRENTS



PLUG FOR TESTING CORD FOR SERIES STREET-LIGHT CIRCUITS

SERIES LIGHTING TRANSFORMERS
Current Test

Instruments:— Sheet No. ..... Tested by— Date .....

Test No.	Circuit No.	Location	Trans. Size	Estimated Load	Meter No.	Meter Constant	Time for 10 Rev. Secs.	K.W. Demand	V.M. Reading	Pri. E.m.f.	Current Amps.	Current, Amps. With Ground Jumper Removed	Current to Ground	Time	O.K.

FORM OF SERIES LIGHTING TRANSFORMER TEST RECORD

from a Mogul lamp; this plug is screwed into a porcelain series socket, which is of similar construction to the film-cutout holders.

The testing procedure is as follows:

1. Be sure connections to ammeters are secure.

2. Fasten ground jumper to the multiple secondary neutral or to the lightning arrester ground.

3. Remove plug from protective device and put in the lead plug—be sure the ground jumper is on the line side of the circuit ammeter.

4. Read current in circuit, and the current to ground if there is any.

If there is a ground current, the plug can be reversed in the protective device, so that the line ammeter is on the line side of the ground jumper ammeter, and the new values of current recorded. Normally there should be no ground on the street-lighting circuit, so there would be no ground current. The line current is also rechecked with the ground jumper removed.

5. Remove the lead plug before removing the ground jumper.

The load on these transformers is metered on the primary side; therefore the primary electromotive force can be found by measuring the voltage across the potential terminals of the kilowatt-hour meter. The kilowatt demand of the circuit is found by taking the time with a stop watch for ten revolutions of the meter disk and calculating it from the constant.

This means of testing is found to be accurate and simple and gives the following data: (1) Primary electromotive force; (2) transformer current; (3) whether the system is grounded or not and the extent of that ground; (4) the kilowatt demand on the transformer, including the transformer losses.

Generator Voltage Control for Skip Hoists

BY C. P. HAMILTON
Industrial Engineering Department, General Electric Company

TWO blast-furnace skip hoists using generator voltage control are to be installed by the Tennessee Coal, Iron & Railroad Company. The hoists are of the balanced type, operating at a normal speed of 400 ft. per minute and will be driven by a 200-hp., shunt-wound, direct-current motor. Each skip will hold a load of 13,200 lb. of iron ore or 2,800 lb. of coke.

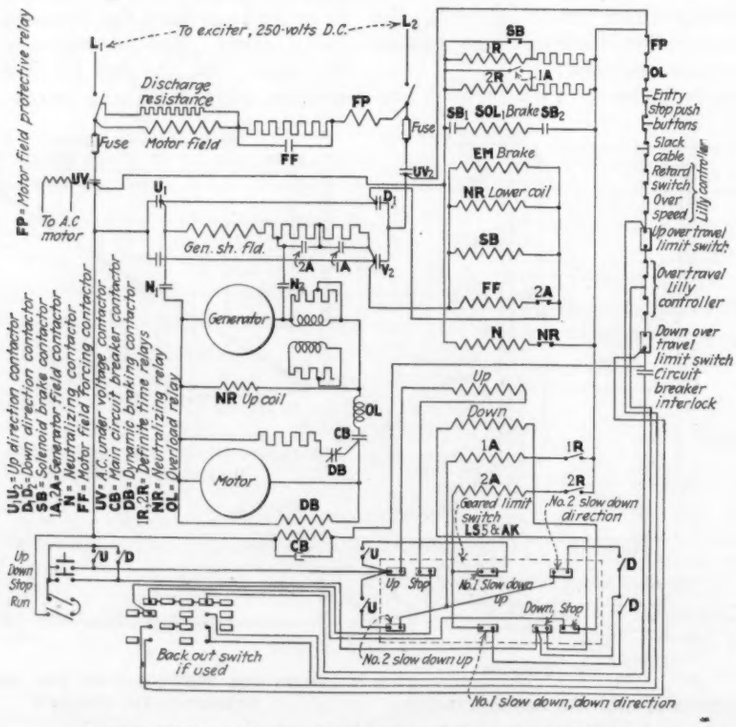
Because of the necessity of distributing the load evenly on the bell at the top of the furnace, it is essential that the skip speed be constant while the load (ore, limestone or coke) is being spilled and that the skip be stopped at approximately the same point each time. Obviously, with such a wide variation in load, the speed regulation would vary greatly during the slow-speed running period—that is, when the generator voltage is about 15 or 20 per cent normal—unless provision were made for correcting this drop in speed with increase in load.

For these equipments a very small amount of series field will be used on the generator, and the motor field will be "forced" during the final slow-speed running. The latter reduces the speed variation because of *RI* drop in the generator and motor armatures, whereas the former corrects for the remaining drop in speed.

Of equal importance to speed regulation is continuity of operation, as it is a serious matter if the skip hoist fails while the furnace is in use. Special attention is therefore given to prevent electrical failures by the use of special insulation in the machine and brake coils and by providing liberal creepage distances on the control panel and using extra capacity control devices.

The control panel will consist of the necessary contactors to control the polarity and strength of the generator field, a motor field-forcing contactor, brake contactors, motor field protective relay, magnetic time relays for controlling the accelerating contactors and brake contactors, an alternating-current undervoltage protective contactor and a line and dynamic braking contactor. There will also be included an overload relay to prevent extreme surges in current between the generator and motor. This will make a comparatively simple control of few and small-capacity devices — except the line and dynamic braking contactor.

A geared limit switch will be used to control the slow-down operation and to bring the skip to a stop. To insure the control circuit being fully open at the stopping point, double-break contacts will be used. Overtravel protection will be provided by track-type limit switches with heat-resisting insulation and non-corrosive parts, as these switches will be



CONNECTIONS FOR BLAST-FURNACE SKIP HOIST CONTROL

located near the tops of the furnaces.

Additional protection will be included, in the form of a "Lilly governor," against overspeed, overtravel and failure of slow-down operation to function at the proper time.

Troubles to Look For

BY HARRY B. TAYLOR
Overhead Lines Department, Detroit Edison Company, Detroit, Mich.

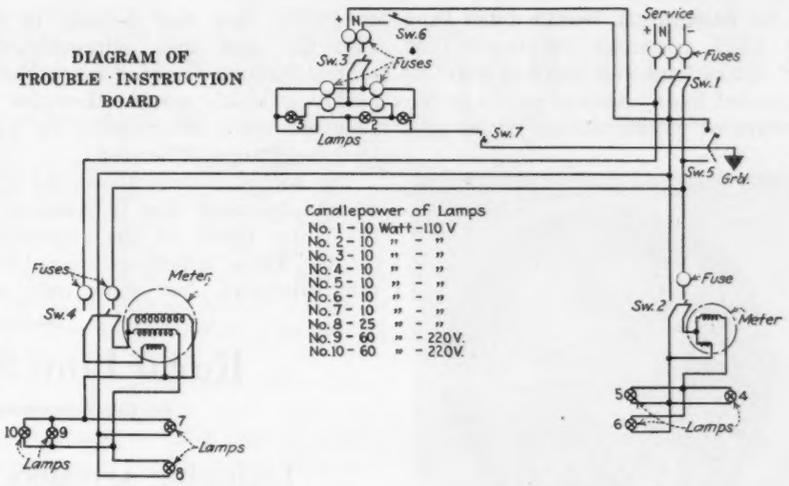
THE service policy of the Detroit Edison Company includes fuse replacement and determination of trouble-causing conditions on the premises of customers. The fuse-trouble man usually acquires his professional education in the experience school of trouble shooting. There are very few text books on the eccentricities of ordinary electrical circuits and their capacities for getting themselves mixed up. On large systems, where the ideal of complete continuity of service is closely approached, it is imperative that the man who responds to the anguished wail of the "electricityless" consumer should know how to locate the trouble with speed and dispatch. The less time he takes to ponder over and figure out the situation the better it is for the customer—and the company.

The innate perversity of inanimate objects usually manifests itself in only a few simple forms, although very frequently the surrounding circumstances contrive to throw a veil of mystery about them. The man who, by experience or training, can detect these forms under the various conditions of their occurrence is a good trouble man. It was with the idea of familiarizing the men with the underlying simplicity of electrical circuit troubles that the board, the circuit diagram of which is here presented, was constructed. The board is about 5 ft. long and 4 ft. high and on its front are mounted the necessary lamps, fuses and switches and two meters, one two-wire and one three-wire. The lamps, fuses and switches are numbered as on the drawing. A three-wire ungrounded supply is brought to the board, as is also a good ground connection. All of the lamps are mounted in key sockets. The normal operating positions of switches are Nos. 1, 2, 3, 4 and 6 closed, No. 7 open and double-throw switch No. 5 up.

Various trouble conditions may be reproduced as follows:

Lamp interconnected between two

DIAGRAM OF TROUBLE INSTRUCTION BOARD



branch circuits. Turn on lamp 2 and show to which side of the line it is connected by removing fuses 6 and 9.

Open circuit in neutral wire in service pipe. Open switch 6 and restore service by grounding neutral inside of building by closing switch 7.

Two branch circuits (one normal, one with high voltage due to ground on hot wire outside of the building and ground on neutral inside of the building, thus blowing neutral fuse 8). Create condition of ground outside by throwing switch 5 down, remove fuse 8, turn lamps 1 and 3 and ground neutral by closing switch 7. Lamp 1 will be normal and lamp 5 will burn very brightly.

Lights normal with neutral fuse blown. Turn on lamps 1, 3, 4 and 5 and remove fuse 2. Upset normal condition by turning on lamp 6 and then bring back to normal by turning on lamp 2.

Combination service, power normal and lights abnormal. Turn on lamps 9 and 10 and remove neutral fuse 2. Neither lamp 7 nor 8 will light by itself, but one will be bright and the other dim when both are turned on. In this case lamp 9 and 10 represent 220-volt power load.

By arranging that ground connections may be made at points on the load side of the two meters the functions of this board may be extended to show those abnormal conditions that affect meter registration. These conditions are omitted from this board, because they would require the addition of variable resistance ground connections, thus adding an unnecessary complexity, since the purpose of the board is the instruction of trouble men, not meter men. Customers have not yet reached that stage of moral perfection in which they complain with the same vigor when the meter stops as they do when the lights go out.

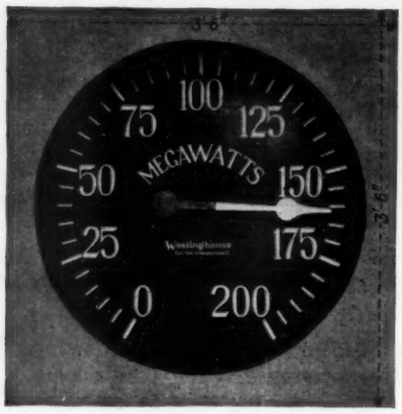
Extensions of Load-Totalizing System

BY P. B. JUHNKE and L. N. MOORE
Commonwealth Edison Company, Chicago, Ill.

THE plant load-totalizing and remote-metering system of the Commonwealth Edison Company, which was described in the issue

TOTALIZING METERS FOR 25 AND 60-CYCLE SYSTEMS IN OFFICE OF CHIEF ENGINEER

of the ELECTRICAL WORLD dated June 18, 1927, possesses the merit that its indications and records may be extended to any desired points in the system or organization. It is only



REMOTELY OPERATED PLANT LOAD INDICATOR IN BOILER ROOM

necessary to add the proper relay equipment to the system to care for the additional instruments. Two examples of such metering extensions are shown here.

In the first the total loads on the 25 and 60-cycle systems are indicated and recorded in the office of the chief operating engineer. It is not essential to the operation of the system that the chief engineer be continuously informed of load conditions through all the minutes and hours of the day, but he does have an interest in these conditions and the information is immediately at hand when he needs it. The records from the instruments furnish him with documentary evidence of load conditions that may be kept in his own file and thus eliminate the search through the load dispatcher's archives, which would otherwise be required when information on past load conditions is desired.

The second picture shows the type of load indicator that is installed in the boiler rooms of the generating plants. These indicators are not system totalizers, but show only the load on the one plant. By this means the boiler operators are kept apprised of what their station is doing and, since the indications are constantly and automatically on the load at all times, boiler room operation does not suffer from the handicap of time lag between load condition and boiler room indication often very apparent in manually operated indicators.

Rural Line Specifications—X

Of the Wisconsin Power & Light Company

Lightning Arresters and Branch Line Cutouts

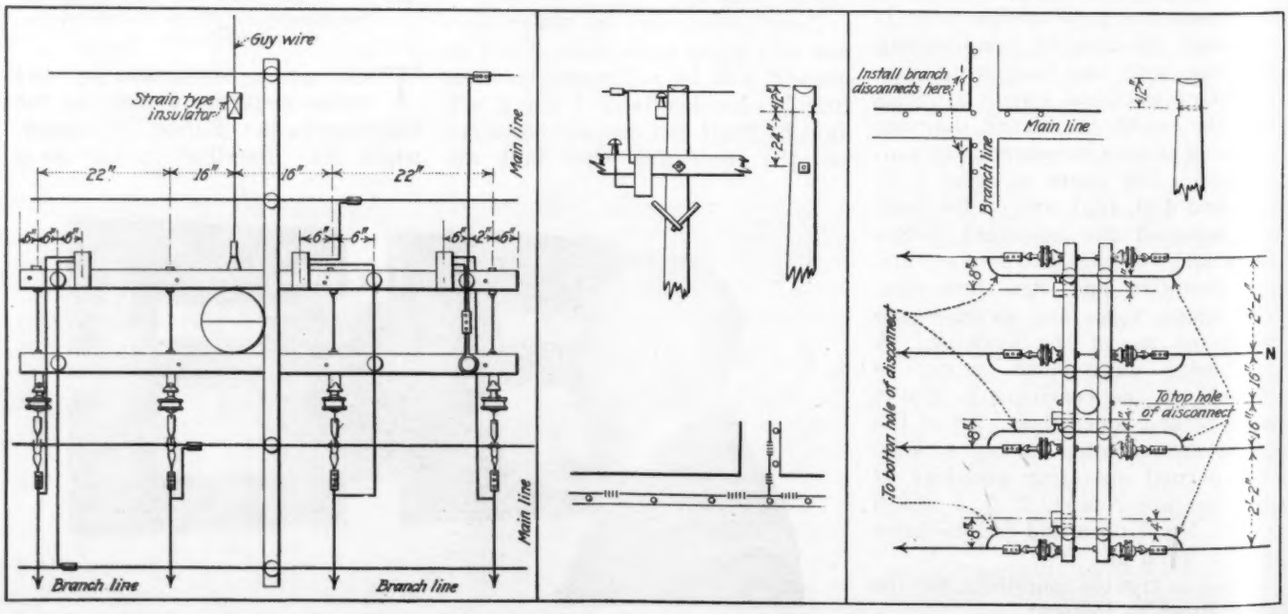
THERE shall be installed at each transformer (except as noted later in Section XII) a set of lightning arresters. If there are more than four transformer installations per mile, only four of such installations need be provided with arresters. These four arrester installations should be made at those transformers that will come the nearest to dividing the one-mile distance into equal parts.

Branch Line Cut-Outs.—The phase or hot conductors of all important branches are to be connected to the main line through fused cut-outs. No cut-out is to be installed for the neutral or grounded conductor. On one-way branch lines it is preferable that the cut-outs be installed on the junction pole in accordance with the drawing herewith. On two-way junction poles the cut-outs are to be installed on the first poles adjacent to the junction or main-line pole, as illustrated.

The cut-outs are to be fused with the proper size fuse wire. While no definite rule can be made regarding the size of fuses, as conditions vary greatly, it is suggested that the capacity of the fuse be equal to 1 amp. for every 4 kva. of transformer capacity connected to the branch line, except that in no case should the fuse be less than 5 amp.

Stores Power Hydraulically

THE electric works at Mittweida (Saxony, Germany) has erected on the Zschopau River a water-power plant with an artificial storage basin of about 3,510,000 cu.ft. capacity located some 360 ft. above an existing power station. When the energy consumption of the local industries is small, water is pumped into the storage basin; a single filling enables some 30,000 kw.-hr. to be generated.



AT LEFT—ONE-WAY BRANCH CONNECTION. AT RIGHT—TWO-WAY BRANCH CONNECTION, SWITCH POLE, ONE POLE FROM CORNER

Commercial Activities and Public Relations

What to Expect from Electric Baking*

By A. N. Otis
Industrial Heating Department, General Electric Company

MOST bakeries are operated during evening and night hours so that the operating schedule and the inherent characteristics of electric heating loads combine admirably to make a long period, steady load at unity power factor—a load that has been eagerly sought.

Ovens for commercial baking are usually about 100 ft. long and 9 ft. wide. They are provided with a conveyor for carrying the material. The connected load is about 500 kw. for a baking capacity of about 5,000 lb. of bread per hour, and the power consumption about 425 kw.-hr. per hour. The heating units must be rugged and well protected from accidental contact, and when so constructed experience has shown that they operate with practically complete freedom from burnouts or shutdowns of any kind.

An oven producing 5,000 lb. per hour and operating ten hours a day can produce about 10 lb. per kilowatt-hour, including the power required for heating up the ovens. At a rate of 1 cent per kilowatt-hour a revenue of $50 per day would thus be produced.

The price at which power can be furnished, in some cases, will be the deciding factor in determining whether an electric oven should be installed or whether other heating methods should be used. Increased operation of power plant units during hours of light loads produces a lower cost for each unit generated during that period and the increased efficiency may often justify a lower rate.

Bakeries are consumers of substantial amounts of power for driving their elevators, mixers, feeders, dividers, ovens, and so forth. Twenty or 30 motors are used in the average large bakery varying in size from ½ hp. to 50 hp. An oven load added to the power already consumed by these motors might make possible a reduced rate for the motor load, which should be credited to the operating cost of the ovens. If continuous operation 26 days a month were instituted in the ovens previously mentioned, baking could be done at a rate of nearly 12 lb. of bread per kilowatt-hour, a gain of 20 per cent in efficiency.

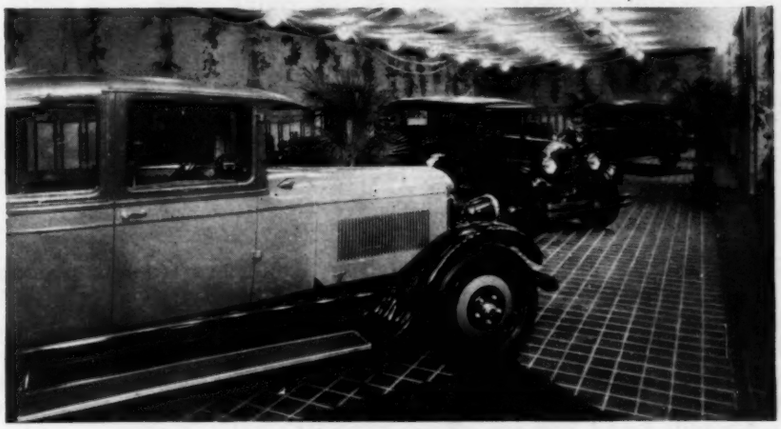
The heating of these ovens offers an opportunity for the central stations to add to their lines a load of considerable magnitude which should prove to be of advantage both to them and to the bakeries, since all factors, such as increasing size of plant, with more nearly automatic and continuous operation, the desirable characteristic of heating loads and the need of central stations for this load, make an exceptionally favorable combination of circumstances.

That this service can be rendered at rates that will compete with gas has been demonstrated by the ovens now in operation.

*Abstract of a paper read at the July convention, East Central Division, National Electric Light Association, Cedar Point, Ohio.

Better Lighting Helps Automobile Sales

By Walter I. Dolbeare
Illuminating Engineer Blackstone Valley Gas & Electric Company, Pawtucket, R. I.



INTERIOR OF CAR DISPLAY ROOM

AUTOMOBILE dealers usually flock together, and nearly every city has its "automobile row," where the Fords and Cadillacs are displayed side by side, where the showrooms are almost the same in appearance and in arrangement. Too often also the lighting of all is uniform and unfortunately uniformly poor. Occasionally some salesman of show-window floodlights unloads several alleged lighting units with color screens of doubtful hue, and one sees freakish color effects which utterly spoil the appearance of otherwise beautifully finished cars.

When the H. W. Tyas Company, dealer in Studebaker automobiles in Providence and Pawtucket, planned to build a new salesroom in Pawtucket, it decided to move from the present "automobile row" to a street outside the downtown district, into a section where there was but one other dealer, who was selling a car far below the Studebaker price. The company made plans for a one-story building with 12,500 sq.ft. of floor space, allowing a display of twelve cars and storage for a hundred. Naturally the lighting was a big problem.

When the lighting service department of the Blackstone Valley Gas & Electric Company was called, the Tyas company was displaying high-grade automobiles in various color combinations on a 102-ft. frontage on a street where traffic moved rather quickly. Accordingly we recommended the use of 44 200-watt Holophane show-window reflectors to give high-intensity foreground lighting, with 27 300-watt Filterlites for general semi-indirect lighting. Our reasons for using semi-indirect units were these: Indirect lighting eliminates shadow, cuts down "high-

WINDOW LIGHTING OF AUTOMOBILE SALESROOM

lights" on the highly polished bodies and allows the dealer to show the various features of the cars without shadows being cast over motors by those standing in line with a direct lighting unit. Fully indirect units lack "life," however, so we recommended a small amount of direct light to give a bright appearance. Modern wash rack lighting and RLM dome reflectors were provided for the storage space.

The Tyas company accepted our recommendations, and the illustrations show the results obtained. The outlets and units were installed as specified and more than twenty convenience outlets were placed in walls, baseboard and ceiling so that any car in the salesroom may be floodlighted from either above or below. The average intensity of illumination that was obtained is more than fifteen foot-candles and the foreground of the salesroom is lighted to almost 100 foot-candles.

And "the proof of the pudding is in the eating"—the Tyas company reports a sales increase of more than 15 per cent!

Installing and Servicing Refrigerators

BY GEORGE A. MARSHALL
General Refrigeration Installation and Service Representative
Public Service Electric & Gas Company of New Jersey

INSTALLATION and servicing of electric refrigerators requires highly intelligent workmen, not only skilled in mechanics but having a working knowledge of refrigerating engineering as well. Since such men are not readily found, how and where can such men be obtained? Listed below are the qualifications required and how to secure men having these qualifications:

First—As few men possess a knowledge of household refrigerating engineering, it will be best to secure the services of a good mechanic and instruct him in the rudiments of refrigerating engineering. That he should be a good mechanic goes without saying; but he should also be a man who can readily absorb instruction and be intelligent enough to apply that instruction.

Second—Persons meeting the foregoing requirements must be taught the rudiments of refrigerating engineering, such as knowing how much refrigeration is required in different sized boxes under various working conditions; where to place his refrigerating equipment and refrigerators so as to obtain the best results; how temperatures are affected by different methods of circulation; what types and how much insulation is necessary under various operating conditions.

The majority of the present-day manufacturers of electric refrigerating equipment conduct regular courses where service men may be taught the theory and application of the foregoing subjects. After having completed the course outlined all newly employed men should work in the field under an experienced man for at least one month. They should then be allowed to work alone under the guidance of the one in charge of service work. Educational meetings should be held once or twice each month, at which knotty problems should be discussed, difficult installations reviewed, advice given and instructions issued.

The next logical step is the organizing of an installation and service department. To secure the best results, assurance of three things should be had:

1. Proper installing of all units.
2. Prompt and efficient service.
3. Co-operation between sales and service.

A hurried installation job or an inefficient one leads to countless service calls, dissatisfied customers and added expenses; whereas an installation properly made lessens service calls, cuts down operating expenses, makes for more and better satisfied customers and leads to more sales.

As an aid to making perfect installations, it is wise to check over the dimensions of the job to be installed, making positive that the proper unit is being installed, that the space surrounding the tank is sufficient to provide proper air circulation, etc. Also, each sale should be accompanied by a data sheet giving the size unit to be installed, the length of tubing to be used, the location of the condensing unit, the voltage, horsepower, cycle, number, phases of motor, etc. This data sheet should be given to the installation man so that he may become familiar with the conditions under which the unit is to be installed.

Proper refrigeration is a 24-hour necessity. When refrigeration stops, food spoils, meals are late and owners are dissatisfied. Sales are hurt and nothing but harm and ill will results. To avoid this, arrangements must be made to give the customer prompt and efficient service at all times—day, night, Sunday and holiday. Only by doing this can satisfactory relations between company and customer be maintained.

The person delegated to this work must be a combination service man and salesman. He must be able to erase any doubts in the customer's mind as to the efficiency of the machine. He must know when to talk to the customer and when not to talk. He must increase the good will of the customer and, above all, he must be able to do his work skillfully, quickly and neatly. Too many times sales are lost and units removed because of the work of an incompetent service man.

The salesman in his anxiety to complete a sale oftentimes sells the prospective user a unit either too small or too large. Cost of operation is often set at a minimum. Units are sold without regard to the conditions under which they are to operate.

The installation and service men often give out statements conflicting with those of the salesmen. Very often they make no attempt to allay

any doubts that may lurk in the customer's mind. They may be too technical in their instructions to the customer, thereby creating the idea that the unit is very complicated and adding to the resistance the salesman must overcome.

These conditions can and must be avoided, and only where close co-operation exists between the two departments can this be done.

A departmental policy must be outlined and adhered to in order that the work may be smoothly carried on. Following is a brief résumé of the policy as followed by the Public Service Electric & Gas Company:

Installation.—The installing of all units must be neatly carried out and only as speedily as is consistent with good workmanship. The installation man must go over in detail all instructions covering the proper running of the unit, explaining to the customer when and how to defrost the tank, when to oil the motor, proper size fuses to be used, how to remove ice cubes from trays, etc. These instructions must also be posted in a conspicuous place, where they can be readily seen and easily read.

Installation Inspections. — All installations must be inspected within 48 hours after installation by a competent inspector. The inspector will file a report as to whether or not the installation meets with his approval, and if not, will note such changes as he would recommend in order that the unit may operate with the maximum results.

Quarterly Inspections.—A contract is sent to each user at the expiration of the free service period, calling for a periodical inspection of the refrigerating unit once every three months. This inspection system is made at a small charge and the inspector will make any adjustments that may be necessary. He also makes any suggestions to the customer which will be of any benefit in the way of obtaining better results and greater economy. He replaces worn and used parts when necessary and these are charged for at regular list prices.

Service. — All service calls are promptly attended to. Those of the greatest importance, such as gas leaks and no refrigeration, receive preference. Men are on duty and available for service at all times of the day and night.

Reports.—In addition to the regular installation inspection report and periodic service report, once every three months a detailed report of each service call is required, giving the name and address of the customer, the date the call was acted upon, the nature of the call and the repairs made. This is gone over carefully by the head of the department, who checks up on any delays in completing calls, etc.

All this work will go for naught unless the best of equipment is provided for doing it. The installation and service automobiles should be fully and properly equipped at all times. A sufficient supply of stock and repair parts is essential, and the stock clerk should keep a constant check on all material, never permitting his stock to get below a predetermined amount. A workshop where entire machine and parts can be renovated and repaired is not only an urgent necessity but is also a saver of time and money.

The foregoing principles, if adhered to closely, will be the basis of keeping the installation and service department in first-class shape and in a condition in which it is likely to do its best work.

Georgia Utility Closes Successful Range Sale

IN ITS small properties outside Atlanta the Georgia Power Company sold 406 electric ranges in 30 days among 12,251 customers by means of an intensive sales campaign just closed. Gross sales amounted to $60,900, and figuring

REPRESENTATIVE ADVERTISING USED IN RANGE CAMPAIGN

an average expected revenue of $4.35 a month per range, a revenue of $21,193 a year will be realized. While 98 per cent of the sales represented new cooking customers, two districts sold 300 per cent of their quotas and the average attained by all the districts participating was 135 per cent.

A special completely installed price was featured with terms of $5 down and the balance in eighteen months. A range of the console type was chosen as the leader, and while the majority of the ranges sold were of this type, a number of larger ranges were placed. The terms, however, were kept the same regardless of the size and price of the unit purchased. In addition to the attractive sales terms, a fourteen-piece set of glass baking ware was given as a premium.

A series of newspaper advertisements was run built around the slogan "the key to better cooking," direct-by-mail letters were sent out stressing salient features of electric cookery and, in addition, two broadsides were delivered to the homes of prospects. All salesmen wore copper-plated keys in their coat lapels or as watch charms in another effort to emphasize the idea of the campaign slogan.

Mimeographed sheets captioned with the title "Range Mints" and carrying apt cartoons outlining the progress of sales were issued daily, with the individual standing of each district and leading salesman shown.

Approximately $500 in prize money was offered, the first award being $75 for the superintendent selling the greatest percentage of his quota and the second $75 to the district selling the next largest percentage. The range manufacturer added a trip to the factory as a special award.

Merchandise Council Takes in Subsidiaries

THE Mohawk-Hudson Power Corporation, having its main office in Albany, N. Y., has formed a merchandise council for the purpose of more effectively co-ordinating merchandising activities of its various subsidiary companies. Through the council it is hoped to standardize the line of appliances being carried by the various subsidiaries in such a way as to reduce stocks, improve the selection of merchandise offered to the public and obtain the most favorable co-operative arrangements with the manufacturers of this equipment.

In addition to M. E. Skinner, commercial manager of the Mohawk-Hudson, and L. A. Jones, purchasing agent, the council includes J. L. Haley, vice-president of the Municipal Gas Company; R. Timmerman, commercial department of the Adirondack Power & Light Company; W. J. Reagan, vice-president of the Utica Gas & Electric Company, and W. C. Pearce, commercial manager of the Syracuse Lighting Company.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

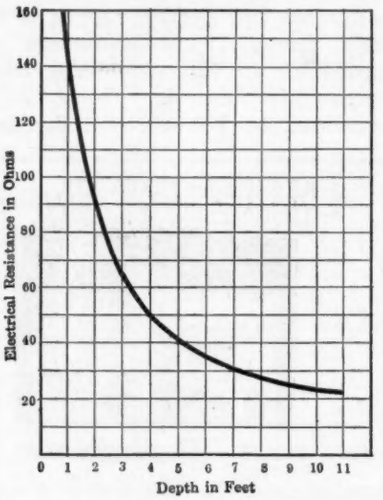
Siemens - Benson Critical - Pressure Boiler.—An experimental boiler designed to operate at the critical pressure of steam is described. This boiler operates at a steam pressure of 3,158 lb. per square inch. as a minimum, regardless of the load that is on it. The general plan of the boiler, operating data and the results of a large number of tests carried out during a considerable period of time are given. Steam generated under conditions of critical pressure could not be used efficiently, for with even the least adiabatic expansion about half of it would at once condense into water. Since its temperature is too high to permit modification of this undesirable characteristic by such heat as constructional materials can stand, the steam, at a pressure of about 3,250 lb. per square inch, is reduced by throttling to 1,500 lb. per square inch and superheated at that pressure to about 800 deg. F.—*Engineer* (*England*), June 24, 1927.

Steam Generation.—R. B. MITCHELL. —After showing the differences between boiler house operation in the electrical supply industry and that practiced in other industries, the author outlines modern methods in a typical large-scale generating station, laying stress on the necessity for ascertaining accurately the amount of coal consumed. The instruments to be installed and the method of logging and recording the readings are described, with emphasis on the value to be gained from an analysis of records. The article concludes with a résumé of the duties of the operating and testing staffs, and a specimen of a typical report from station superintendent to chief engineer.—*World Power* (*England*), June, 1927.

Transmission, Substations and Distribution

The Stabilization of Long-Distance Power-Transmission Systems. — This article gives the outline of a new plan that greatly enlarges the field of long-distance electric power transmission and opens for economic development new sources of power, such as remote waterfalls or beds of cheap low-grade fuel. The increased lengths of transmission lines, higher voltages, greater spacing between conductors and larger diameters of conductors increase very considerably the capacity and the reactance of transmission lines. From the stability point of view, resistance and capacity are not so important, but reactance is a factor of primary importance. The amount of power, however, that can be transmitted over a certain distance is proportional to the square of voltage and therefore a voltage drop means a decrease in power that can be transmitted and an eventual loss of synchronism in the system. The means devised for supplying this reactive current and thereby maintaining the voltage all along the system are synchronous condensers, distributed along the transmission system, which supply reactive current at each point commensurate with the requirements of the system at any given moment. Such condensers must be supplied with automatic voltage regulators and quick response exciting systems so that, in case of a disturbance, the voltage regulating equipment responds in the fraction of a second.—*Mechanical Engineering*, July, 1927.

Grounding for Service and Safety.— E. M. WOOD.—Constitutes a comprehensive discussion of the best practice as determined from the results of many experiments with different grounds, tests and maintenance problems. The ground connection, use of water-pipe grounds, primary and secondary neutrals tied in with station grounds and



VARIATION OF ELECTRICAL RESISTANCE WITH DEPTH OF PIPE DRIVEN IN MOIST SOIL

design of ground electrodes are considered by the author. Data of observations and experiments conducted to investigate this subject are given in detail. — *Electrical News* (*Canada*), July 1, 1927.

Generation, Control, Switching and Protection

160,000 *Kw. Steam Turbo Set for Hell Gate.*—F. FABER and E. HUNZIKER.—A European concern was given the contract for a twin set steam turbo-generator, designed to give a maximum continuous load of 160,000 kw. and to fit in a space 40 ft.x65 ft. This article gives complete drawings of both the prime movers and the generators and describes the sets in a general way. Limited floor space prevented reaching as high an efficiency as modern design practice would otherwise have allowed. With a load of 90,000 kw., the steam end reaches 83.4 per cent and the electric part 95.8 per cent over-all efficiency. The set comprises a high-pressure unit of 75,000 kw., at 1,800 r.p.m., and an 85,000-kw., 1,200-r.p.m. low-pressure unit. Both three-phase generators deliver 13,800 volts, the former machine being four polar, the latter six polar. The axial length of the active iron of each generator is 151 in., the rotor diameter of the high-speed unit is 59 in., and the lower speed rotor measures 82 in. in diameter. Both generators are artificially air cooled with a closed circulating air system, but, contrary to common practice, the blowers are mounted as a separate complete unit on the extended shaft outside the rotor bearing. The circumferential speed of the rotors reaches 428 and 460 ft. per second, respectively, values well within safe limits of modern design and high-grade steel. The complete four-polar generator weighs 200 tons, the six-polar machine 260 tons; the rotors alone weigh 62 and 100 tons respectively. — *Elektrotechnische Zeitschrift*, June 23, 1927.

Motors and Control

Rheostat with Many Points.—For resistance regulation in many fine steps, or for field regulation of generators within a very wide range, a rheostat design is described which permits several times as many points as is customary on the well-known circular type. The contact points are arranged along a spiral, of three or four turns, and a radially movable brush contact is lodged within the operating handle. Such a design makes it possible to place on a relatively very small panel from 100 to 1,000 contacts, which can be covered by two to four turns of the handle. To provide an indicator which does not travel more than 360 deg. for the whole range a simple gearing is introduced between the operating knob and the contact handle. To avoid confusion this indicator moves in the same direction as the knob.—*Bulletin Oerlikon*, June, 1927.

Starting Tests with Three-phase Motors.—M. KLOSS.—In European countries the use of squirrel-cage armature three-phase motors is greatly restricted, owing to the large fluctuations caused in the network by the high starting current. Attempts have been made in late years to permit the more general application of these simple and reliable motors by suppressing the high inrush current in a mechanical way. A great variety of centrifugal clutch pulleys have come into use, all so designed as to permit an idle start of the motor and gradually to grip the load as the speed rises. These pulleys, in conjunction with a star-delta starting switch, diminish the starting current greatly. Systematic tests with such equipment are reported in this article, and starting conditions are illustrated with calibrated oscillograms.—*Elektrotechnische Zeitschrift*, May 26 and June 2, 1927.

New Homestead Structural Mills.— C. A. MENK. — Two new groups of structural mills replacing those formerly used are described in this paper. Group No. 1 consists of a blooming mill, a roughing mill and a finishing mill, and is designed to handle structural shapes, panels, I-beams, angles, etc. Group No. 2 consists of roughing, intermediate and finishing stands for exclusive manufacture of the new Carnegie beams. Electrical drive is used

throughout. The 54-in. mill in group No. 2 is capable of handling ingots weighing 30,000 lb. It is served by what is stated to be the largest reversing motor in the world, which has a continuous rating of 8,000 hp. at 40 r.p.m. and a maximum torque of 3,500,000 lb.-ft. The flywheel set consists of 5,000-hp. driving motor, 150,000-lb. flywheel and two 3,350-kw., 700-volt, 368-r.p.m. generators operating in parallel. Carnegie beam hot blooms from the 54-in. mill are conveyed directly to the 52-in. roughing mill. Roughing and intermediate mills are duplicates, each consisting of an edging stand operating in tandam with the main stand. Each stand is driven by a separate reversing motor.—*Iron Age*, June 23, 1927.

Heat Applications and Material Handling

A New Rotary Pump.—A new design of rotary pump of the sliding-vane type, which is said to be free of wear at the end of the blade, and consequent loss of efficiency in the pump owing to the scouring of the inner walls of the pump chamber, is described in this article. It consists essentially of a hollow rotor eccentrically placed within a chamber. There is no rubbing contact between the ends of the blade and the chamber wall, no matter at what head the pump is working.—*Engineer* (*London*), *June* 24, 1927.

Strains in Dished Heads.—E. HOHN.—Through a number of independent experiments the best form for dished heads was determined by the author. From the values of measured stress conditions on the outside the strain conditions on the inside are calculated. For each point the measured strains were taken as a function of the pressure and the starting point rechecked. From the strains the stresses were evaluated, and as the former are proportional to the latter, it was only necessary to find a correct proportionality factor. It seems to the author that the stresses should be evaluated according to their effect, namely, the elongations produced, which are easily measured. The magnitude of the elongation is a measure of the danger of failure. The calculations can be so arranged, according to the author, as to determine the elongation consistent with a specific degree of safety. However, if engineers continue to calculate with stresses, it is necessary to use reduced stresses in their calculation for safety.—*Mechanical Engineering*, June, 1927.

Mechanical Strength of Bakelized-Paper Tubes and Plates.—K. SCHAUDINN and L. TRAEGER.—Modern practice in the design of high-voltage apparatus makes extensive use of cylinders, tubes, plates and rods made of rolled or laminated, Bakelite soaked paper. While this material is used chiefly as a dielectric, it is occasionally subjected to considerable mechanical stresses. It is the purpose of this article to investigate tensile, bending and torsional mechanical strength of such materials. The data given cover the dry, oil-soaked and hot, oil-soaked material as well as tests made parallel and at 90 deg. to the laminations.—*Elektrotechnische Zeitschrift*, June 23, 1927.

Electrophysics, Electrochemistry and Batteries

The Hysteresis Loss in the Damped Oscillating Magnetic Field.—HIKOICHI OBATA.—A simple method for the estimation of hysteresis loss is developed upon the assumption that the hysteresis spiral may be approximately replaced by an elliptic spiral, introducing the hysteresis angle and also that of the spiral, so that the system obtained consists of mean ellipses. By the use of the formulas so obtained, some numerical calculations have been made for the hysteresis loss for various damping coefficients and frequencies of oscillation of the applied magnetic field. The results indicate that the loss depends on the value of the damping coefficient, especially for the small damping and the low frequency magnetic field. The effect of frequency on the loss, while it gives the linear relation, becomes negligible for the highly damped field. Expressions for the distribution of magnetic fields and iron loss for sheet steel and illustrative curves and tables are given.—No. 195, *Researches of the Electrotechnical Laboratory* (*Japan*).

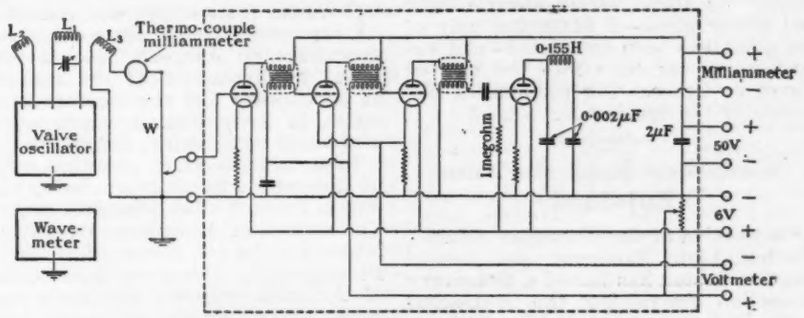
The Prandtl-Nadai Torsion Theories and Their Applications.—The determination or the state of stress in twisted shafts was made by Prandtl some twenty or more years ago, when he pointed out that the direction and magnitude of the shear stress, and also the twisting moment, can be determined from the geometrical properties of a membrane stretched across a box of the same shape as the shaft and expanded under constant pressure. The conclusions derived as a result of a large number of experiments with plastic stress developments in shafts are given here. Detailed measurements of the stress distributions due to notches and holes of various shapes in steel plates and the corresponding distributions in transparent plates indicate that photo-elastic experiments on notched plates give correct results for steel members.—*Engineering* (*England*), June 24, 1927.

Traction

Catenary Construction for Chicago Terminal.—J. S. THORP.—A description of the procedure followed by the Illinois Central engineers in the layout, design and erection of the catenary system for the electrification of approximately 50 miles of suburban trackage with a 1,500-volt d.c. supply is outlined in this paper. Spans, spacing, loading, structure foundation, sag curves and maintenance data receive attention.—*Journal American Institute of Electrical Engineers*, July, 1927.

Telegraphy, Telephony, Radio and Signals

Performance of an Intermediate-Frequency Amplifier.—M. G. SCROGGE.—This paper gives the results of measurements carried out on an intermediate-frequency amplifier forming part of a commercial supersonic heterodyne receiver designed for broadcast reception. The amplifier is described, with special reference to the coupling transformers. Slight modifications of the circuit are necessitated by the method of test, but it is concluded that the conditions of measurement approximate closely those of normal use. Three representative types of valves are employed in turn and it is shown that, for a prescribed standard of cut-off at the extremes of the side-bands, the amplification obtainable increases with the mutual conductance of the valves. The best type of valve to use in various circumstances is deduced from the results obtained.—*Journal of the Institution of Electrical Engineers* (*England*), June, 1927.



METHOD OF MEASURING INTERMEDIATE FREQUENCY AMPLIFICATION

Miscellaneous

Standards of the Hydraulic Society.—The fourth edition of the standards of this society contains sections devoted to definitions and values; extracts from pump test codes; a revised pump classification; description of types, parts and definitions pertaining to the several classes of pumps (reciprocating, displacement, rotary-displacement, centrifugal and deep well); instructions for installing and operating each type; a recommended contract form for use in the pump industry; data, tables, curves and formulas, including pipe friction data for both water and oil and a comprehensive list of materials recommended as being the most suitable for pumping different liquids.—*The Hydraulic Society* (*New York*).

Recent Developments in Cast-Iron Pipe.—H. Y. CARSON.—Recent improvements in the methods of casting iron pipe are described in this article as well as developments in the bronze-welding and cement lining of these pipes. Cement lined mains are described as being far more dependable than tar dipped pipes and are credited with bringing about an increase in flow capacity with the same unit drop in pressure.—*Canadian Engineer*, June 28, 1927.

News of the Industry

Baltimore Company Asks Ratification of Extensions

Construing the decision of the Court of Appeals, given July 23, to mean that several millions of dollars had been invested in illegal construction of the system of the Consolidated Gas, Electric Light & Power Company of Baltimore, Charles Markell, Jr., counsel for the company, filed with the Public Service Commission an application requesting approval of all extensions of gas and electric plants, lines, works and system made without the permission of the commission. This application covers construction work carried on between June 1, 1922, and June 1, 1927, it is stated.

The application includes the request that the commission allow it to "construct" its Gould street electric light and power plant—a $4,000,000 unit of the plant has been completed—and extend its power lines into the city of Havre de Grace. The commission has scheduled the hearing for Aug. 3.

Worcester Rate Decision Enjoined

On petition of the Worcester (Mass.) Electric Light Company the federal court at Boston has issued a temporary injunction restraining the Massachusetts Department of Public Utilities from enforcing its recent decision reducing the maximum rate of the company from 7 to 5 cents per kilowatt-hour. This is the first step on the part of the company toward carrying the case to the United State Supreme Court on the ground of threatened confiscation.

The recent decision of the commission has attracted nation-wide interest on account of its drastic character and vigorous affirmation of the validity of the so-called Massachusetts theory of rate regulation on the basis of the investment in the property as contrasted with the reproduction cost less depreciation rate base.

Scenic Beauty Protected by Commission

The recent action of the Department of Public Service of New York state in denying the application of the Commonwealth Power Company for a permit to develop hydro-electric power on the upper Genesee River not only removed a potential competitor of the Rochester Gas & Electric Corporation but it is believed that the commission does not favor the construction of any storage dam that would interfere with the Letchworth State Park at Portage or wipe out Portageville and other small places to the south.

Owing to the fact that all of the commissioners were opposed to the proposal of the Commonwealth corporation, no hearing was held or deemed necessary, so the details of the plans were not made public. However, it has been learned that the plans called for building a storage dam just south of the Erie Railroad bridge over the Genesee River, at Portageville, and that this dam would have flooded the valley for about 17 miles, creating a lake larger than the storage dam at Mount Morris will make.

The rebuff to the Commonwealth company is taken to mean that the state does not intend to permit the building of any more dams in the Genesee River in the neighborhood of Letchworth Park and that the storage dam of the Rochester Gas & Electric Corporation will be the only one in the river between Mount Morris and Caneadea. The dam now under construction by the Rochester power concern does not in any way affect Letchworth Park.

Federal Power Policy Scored

Governor Graves of Alabama Attacks the Muscle Shoals Situation and Governor Dern of Utah the Colorado River Project

TWENTY governors and the official representatives of three other state executives on July 25 devoted themselves to discussions of the condition of agriculture and the interest of the states in hydro-electric power at the conference at Mackinac Island, Mich.

In an address which provoked a flood of discussion, participated in by Governors Dern of Utah, Hammill of Iowa, Christensen of Minnesota, Brewster of Maine and former Governor Pinchot of Pennsylvania, Governor Bibb Graves of Alabama assailed the government policy of selling electric power developed by government plants at Muscle Shoals.

He drew a distinction between dams constructed for aiding navigation and those for developing power. He said that by the government selling power to the Alabama Power Company at 2 mills a kilowatt-hour more than $160,000,000 worth of property was turned over to competitive commercial usage and the State of Alabama is unable to collect any taxes.

Governor Graves insisted that the property should be kept in stand-by condition ready to produce nitrogen for war purposes, or turning out fertilizer for American agriculture, also a national service.

Governor Dern of Utah said that for the government to step in and construct Boulder Dam in the Colorado River would be a usurpation of state rights, and that while he sympathized with California's desire for a dam, Utah people insisted that state's rights be considered.

Mr. Pinchot said that so far as law is concerned the federal government has the right to build Boulder Dam. Gov. Ralph O. Brewster of Maine, who presided at the opening session as president of the governers' conference, in an address declared himself heartily in favor of a marked increase in the American merchant marine and asserted the government should not hesitate to provide a necessary and an adequate permanent fleet to protect the interests of commerce.

Important developments in regard to the exportation of surplus hydro-electric power from Maine were forecast on Wednesday in an address of Gov. Ralph C. Brewster of that state. Governor Brewster advocated an interstate compact with provision for regional rather than federal control of the amount of power exported and the rates to be derived therefrom. Discussions have been held recently by representatives of Maine, New Hampshire and Massachusetts, under the auspices of the power committee of the New England council, looking toward an entente in power interchange, and the outlook is hopeful for constructive action.

Federal Power Activities

Saluda River License Accepted—Engineer to Visit Project in California and Washington

THE Lexington Water Power Company has accepted the draft of the license covering its project on the Saluda River. The license itself will be executed and delivered by Aug. 1, it is believed, at which time it is understood the company will let construction contracts with the idea of starting the work on its dam at an early date.

The Federal Power Commission's technical staff is now analyzing the designs for the city of Seattle's Diablo Canyon arch dam. The dam is to be 385 ft. high. Four designs have been submitted. Careful consideration is being given to the questions of safety and economy involved.

The studies of the project have progressed far enough to leave little doubt that the site is well adapted to a dam of that type, but final approval has not been given any one of the plans submitted. A protest against the impounding of such a large amount of water has been filed on behalf of the people below the dam who would be endangered in case of its failure.

Major Glen E. Edgerton, the chief engineer of the Federal Power Commission, is en route to the west coast,

where he will visit all of the projects on which the commission will be required to take action in the near future. Among others, he will visit the projects of the Southern California Edison Company on the headwaters of the San Joaquin River, the project of the San Joaquin Light & Power Company on Kings River, several sites on the Tuolumne River, the projects of the Southwest Power Company on the Feather River, those of the Pacific Gas & Electric Company on the Pit River, as well as those of the city of Seattle.

Electric Cultivation

Sweden Experiments with Heated Soil and New York Inventor Treats Land with Electricity

THE Swedish Agricultural Department has been conducting experiments in forcing the cultivation of farm products and flowers by means of heating the soil by electricity, with satisfactory results. It is possible in many instances to produce early spring vegetables even in the far north of Sweden, where electric power is cheap and the rays of the sun are relatively strong in the spring, although the ground is usually frozen at that time.

Lettuce is ready for sale in March, and the Swedish experts hope to be able to modify the seasonable environment to such an extent that lettuce may be put on the Christmas market, and potatoes harvested in the early part of June.

The first attempt was made with a current of 5 to 25 volts sent through a lead wire, not insulated, which ran underneath the ground. This method, however, was found to be impractical owing to leakage. The next trial was made with a specially manufactured heating cable in six forcing beds in a market garden near Stockholm and the results obtained were quite satisfactory.

A large landowner in New York State is attempting to prove to his own satisfaction the value of electricity in agriculture. He is Donald Woodward, a financier, and one of the leading citizens of Genesee County. Mr. Woodward has set apart from his farm 15 acres, divided into two equal tracts. On one of these his manager has expended about $1,000 in the purchase of the most approved kinds of fertilizers, in the preparation of the land, and in the planting of corn, beans and potatoes.

The other tract has been turned over to H. L. Roe, inventor of an electric cultivator, who has stipulated to produce two ears of corn to the manager's one, and this without the use of either fertilizer or sprying compounds.

The manager had all his crops in by the first week in June, but Roe devoted the three weeks to "shooting electric current into the soil" with his peculiar invention. Although he did not do his planting until long after his rival had completed that portion of his work, it is noted that while sixteen days were required for the manager's corn and beans to show above the surface those crops planted in the electrically treated land were up in five days. Potatoes planted by the manager remained hidden for 21 days, whereas the "spuds" on the Roe tract sent forth their tiny shoots in just nine days.

Texas Hydro Development

Features of Construction of the Three Plants Now Under Way on the Guadalupe River

A REAL contribution to hydro-electric development in Texas is being made this summer by the Texas Power Corporation in building the three dams on the Guadalupe River previously referred to in these columns.

The two upper dams will each have a pond of about 400 acres area, and the lowest dam one of 150 acres. The lakes thus formed, though small, will be an asset to that section inasmuch as there are no natural lakes which can be used for resort purposes. The spillways for the dams will incorporate bear-trap gates constructed in accordance with designs of Huber & Lutz of Switzerland. This will be the first installation of such collapsible gates in this country, although numerous installations have been made abroad. This type of gate has special advantages when rivers are subject to sudden high floods and when the cost of flowage land is high. Each of the three spillways will consist of three of the bear-trap gates, 85 ft. long and to retain 12½ ft. of water. The gates will be automatic in operation so that as flood occurs they will fold down flat, permitting the spilling of 12½ ft. of water without raising the pond levels at the dams. The spillways are designed to care for a flood peak nearly double that of the 1913 flood. Of the three plants, the middle one will be manually operated, and an attendant will always be present. The upper and lower ones will be operated as automatic remote-controlled plants from a switchboard at the middle plant.

The first plant, about 6 miles southeast of New Braunfels, will have an operating head of approximately 44 ft. under normal operating conditions. In it there will be two 2,600-hp. waterwheels driving two 2,250-kva. generators, two governors, remote-control equipment and switchboard. The middle plant will be 5 miles below the first one and will include two 1,900-hp. waterwheels, two 1,750-kva. generators, two governors and switchboard. The dam will be 32 ft. high. About 8½ miles below the middle plant will be the third one, with an operating head of 25½ ft. It will have two 1,650-hp. waterwheels, two 1,550-kva. generators, two governors, remote-control equipment and switchboard.

All the dams will be of reinforced concrete. Each plant will have an outdoor substation with three single-phase transformers, complete with lightning protection and switching equipment. All electrical equipment is of General Electric manufacture.

Power will be generated at 2,300 volts, three-phase, 60 cycles. The voltage will be stepped up at each plant to 13,200, and a tie line operating at this voltage will carry all power to a central point at the middle section, where it will be delivered to the system of the Comal Power Company. "Selsyn" remote indicators, similar to those in use at the Panama Canal, will give the operator at the middle plant the water level and gate position at all plants. Indicating wattmeters, power-factor indicators and ammeters at the middle station will give an indication of the load at the two remote plants. Thus the load can be governed to suit flowage or pondage conditions, and the remote plants can be controlled as economically and efficiently as the manually operated station. The engineering of these projects is being done by the Fargo Engineering Company of Jackson, Mich.

Working Agreement Between British Cable Manufacturers

Developments in the British electric cable making industry in the direction of closer working arrangements were disclosed in speeches made at the recent general meetings in London of Callendar's Cable & Construction Co., Ltd., and W. T. Henley's Telegraph Works, Ltd. An agreement among the three leading British manufacturers, namely, the two companies already mentioned and the British Insulated Cables, Ltd., has been reached whereby the research departments of the three concerns are to work in close co-operation and there is to be a general use of patents and secret processes employed by each company individually.

Further, the agreement provides for the exchange of all information as to production, business methods, arrangements for supply and distribution, and generally for the avoidance of waste and duplication. As a result of the closer working the companies anticipate being able to supply superior cable cheaper.

Farmers' Complain of Poor Service

In the interests of better electric service to agricultural consumers throughout California, the Railroad Commission of that state has appointed two engineers whose duties will be to make inspection of all complaints of low-voltage or inadequate electric service.

In its announcement the Railroad Commission stated in part:

"This action was taken by the commission in response to complaints from farmers and orchardists that during periods of heavy pumping during the summer irrigation season the power voltage would drop so low that their motors would be unable to pump sufficient water, and in many instances would "kick off." The farmers complained in a number of instances that they were subjected to a loss, due to failure of the power at the critical period of the irrigation season.

"Inspections made in the past by engineers of the Gas and Electric Division of the Railroad Commission showed that failure of the power is usually due to insufficient capacity of the feeder wire serving a number of consumers, or failure of the utility to maintain the station voltage. In some instances lowering of the water table has been responsible for conditions which complainants ascribed to power trouble. In no case was the unsatisfactory conditions due to an actual shortage of power."

Electricity in Tennessee

Growth of the Tennessee Electric Power Company in Five Years and Its Effect on the Communities Served

GREAT progress has been made in Tennessee in the last five years in bringing the benefits of electric light and power service to the smaller communities in the state. Electric lines have been extended farther and farther away from the main transmission systems so as to cover practically every county with a network of wires.

Especially is this true throughout middle and eastern Tennessee, in the territory traversed by the system of the Tennessee Electric Power Company. Since 1922 this company has added close to 100 communities of varying sizes to its system.

During this time the benefits of electricity have been made available for the first time to inhabitants in the following towns: Ashland City, Apison, Caryville, Campaign, Chickamauga, Crossville, Concord, Cumberland City, Clairfield, Crab Orchard, Coalfield, Daisy, Dowelltown, East Ridge, Englewood, Friendsville, Farragut, Granville, Gainesboro, Graysville, Gorman, Hohenwald, Jacksboro, Keltonburg, Liberty, Lancaster, Morrison, Monoville, New Market, New Middleton, Oakdale, Pleasant Shade, Petros, Riceville, Russell Hill, Smartts, Soddy, Sale Creek, White House, Villette, Coulterville, Briceville.

In addition the company has purchased from local people the lighting properties in Athens, Algood, Baxter, Benton, Carthage, Centerville, Clinton, Coal Creek, Dixon Springs, Doyle, Erin, Goodletsville, Greenbriar, Harriman, Hartsville, Hickman, Jefferson City, LaFayette, Loudon, Lenoir City, LaFollette, Livingston, Madisonville, Millersville, Maryville, McEwen, McMinnville, Monterey, Murfreesboro, North Alexandria, Oliver Springs, Ooltewah, Oneida, Quebeck, Red Boiling Springs, Riddleton, Ridgetop, Smithville, Sparta, Strawberry Plains, Symrna, Tellico Plains, Walling, White Pine, Waverly, Woodbury, Walter Hill, Emory Gap, Collegedale, South Harriman, Tennessee Ridge.

In practically every instance after purchasing these local properties the systems have been expanded to serve new customers and largely rebuilt to improve the character of service and to conform to the engineering specifications of the power company.

In a few cases of communities too far removed from the Tennessee Electric Power Company's transmission lines, the company continues to operate local generating plants, at the same time giving 24-hour service as prevails in the largest cities served. At the present time such power plants are being operated in Baxter, Crossville, Centerville, Erin, LaFollette, Hohenwald, Monterey and Oneida. During recent months similar plants have been closed down at Algood, Carthage, Livingston, Soddy, Graysville, McMinnville, Waverly and Harriman by extension of transmission lines.

This expansion and growth of electric service lines throughout middle and eastern Tennessee has resulted in a number of outstanding and distinctive benefits to the public welfare, namely: (1) The supplying of electric service to people and communities not heretofore enjoying such service; (2) making 24-hour service available where previously a limited amount of electricity could be obtained only at certain specified hours during the day or night; (3) providing sufficient power and light to enable industries and all users to expand their operations at will; (4) permitting the electrification of manufacturing plants with consequent saving in fuel and operating costs; (5) attracting new industries into the territory; (6) furnishing employment to additional people in new and enlarged industries; (7) increasing the wealth of the communities and distributing the tax burdens of the people; (8) providing an investment opportunity for thousands of citizens through capital employed in carrying out such a program of expansion and development work.

Measurements of Flow of Colorado River

The Geological Survey of the Department of the Interior has just issued one of its series of annual water supply reports giving the results of the government's stream measurements in the Colorado River basin. In co-operation with various states and other organizations interest in the flow of the Colorado, the Geological Survey maintained during the year ended Sept. 30, 1923, some 80 stream-gaging stations, at most of which were obtained records of daily flow of the river and its tributaries, covering a great drainage basin of some 242,000 square miles.

The first table in the report gives the flow of the Colorado at a point in northern Colorado, where the river is a tiny stream with a flow at times of less than 100 cu.ft. a second. During the summer flood, which resulted chiefly from melting snow in the high altitudes of the headwater streams, the flow in the Grand Canyon and downward to the mouth was over 100,000 cu.ft. a second.

The Colorado River report, listed as Water-Supply Paper 569, is largely statistical and covers 175 pages.

Electricity in Bituminous Mines

Electric locomotives, electric light and electric motors are rapidly replacing the mine mule and the miner's lamp in the coal mines of the United States, according to a survey just made public by the United States Bureau of Mines.

Of the total output of bituminous coal, 88 per cent now comes from mines using underground locomotives, and 1,512 mines are using locomotives exclusively. Of all the mine locomotives in service 98 per cent are electric.

At present only 37,000 animals are at work in coal mines, while there are in use 14,723 locomotives of all types. Of these, 14,280 are electric.

It is estimated that more than a quarter million electric miners' lamps are now in use, notably reducing the danger of fire and coal-dust explosions and materially increasing the miner's output.

In addition to electric locomotives and lamps, electric ventilating systems and coal-hoists are being installed, while there has recently been completed in a Pennsylvania mine an electric belt-conveyor which carries coal at the rate of 1,500 tons an hour, four and a half miles directly to barges on the Monongahela River.

Worcester Gas-Electric Merger Off

The Massachusetts Department of Public Utilities has dismissed a petition for the consolidation of the Worcester Electric Light Company and the Worcester Gas Light Company on the ground that it is not in the public interest. The petition was filed in August, 1926, but pending the disposal of rate proceedings before the board it was held in commission on request of both companies. The gas company withdrew its petition for consolidation subsequent to its acquisition by interests affiliated with the Associated Gas & Electric Company of New York, but the electric company did not withdraw.

In its finding the board points out that under the new control the gas company should benefit as much from efficient management as though the electric company should acquire the property, and states that the refusal of the electric company to submit to the regulation of its rates in accordance with the long prevailing practice of the state of Massachusetts (the company has secured a temporary injunction from the federal court against the commission's recent decision reducing its maximum rate from 7 to 5 cents) does not hold out for the consumers of gas in Worcester the promise of any more liberal treatment than they will receive at the hands of the new owners.

Electrochemists to Visit Power Installations of Nortwest

Power development in the Northwest has been progressing on an elaborate scale and electrochemists are interested in new centers for the establishment of various electrolytic industries. The American Electrochemical Society has therefore arranged a trip through the Northwest, visiting the power installations at Spokane, Seattle and Great Falls, in addition to the hydro-electric station at Keokuk in the Mississippi River.

Three scientific sessions will be held en route, one at Minneapolis, Minn.; another at Vancouver, B. C., and a third at Keokuk, Iowa. Papers on such important subjects as "Electrodeposition of Rubber" and "Thin Film Rectifiers" will be presented for discussion.

The itinerary of the trip includes a visit to the metallurgical plant at Trail, B. C., and the mines, smelters and refineries at Anaconda, Wallace, Kellogg and Butte. The new 7-mile tunnel being bored through the Cascade Mountains will be inspected, as well as the oil fields at Shelby. One day will be spent at Glacier National Park. The special American Electrochemical Society train will leave Chicago on Sept. 4, returning Sept. 21.

Purchases and Mergers

Buffalo, Niagara & Eastern Power Corporation Increases Its Holdings in New York State

THE Department of Public Service of the State of New York has granted the petition of the Buffalo, Niagara & Eastern Power Corporation to acquire the Western New York Utilities Company, which furnishes gas in the incorporated village of Albion and electricity in the city of Batavia, the incorporated villages of Albion and Medina and other municipalities in the counties of Erie, Genesee, Monroe, Niagara, Orleans and Wyoming, N. Y.

The Central States Electric Company of Nebraska has purchased the hydro-electric plant of the Beatrice Power Company, located near Barneston, Neb.

The Department of Public Service of the State of New York has permitted the Adirondack Power & Light Corporation to acquire the Consolidated Electric Company, which furnishes electricity in the incorporated villages of Greenwich and Cambridge, Washington County; Schuylerville and Victory Mills, Saratoga County, and in the towns of Greenwich, Easton, Jackson, Cambridge and North Creek, Washington County, and Saratoga and Northumberland, Saratoga County, N. Y.

The Niagara Electric Service Corporation has purchased the entire properties of Lewiston Power Corporation, which distributes service throughout the towns of Lewiston and Porter and the villages of Lewiston and Youngstown and the hamlet of Ransomville, N. Y.

The Central Mendocino Power Company of Willits, Cal., supplying electric power and water to Willits and surrounding territory, has been sold to the W. B. Foshay Company of Minneapolis, Minn.

The Lindsay Power & Light Company, Manawa, Wis., has been acquired by the Wisconsin Power & Light Company of Madison. The sale included the hydro-electric plant at Manawa and transmission lines to Symco, Ogdensburg and the intervening territory.

The Avon Milling Company plant, which has been furnishing electric power for Avon, Ill., has been acquired by the Illinois Power & Light Corporation.

The Wooster (Ohio) Electric Company has been sold to the Electric Public Service Company of Chicago.

Fenton W. Barber, operating an electric light and power plant in the town of Lewis, N. Y., has asked the Department of Public Service, State of New York, for permission to transfer his franchise from the town and his operating plant to the Plattsburgh (N. Y.) Gas & Electric Company.

The municipal light and water plant of Port Gibson, Miss., has been sold to the Mississippi Public Service Company.

The plant of the Monroeville (Ala.) Ice & Power Company has been sold to the Gulf Utilities Company.

The Georgia Power Company has purchased the privately owned distribution system and water-power plant at Ball Ground, Ga.

The Seneca River Power Company of Baldwinsville, N. Y., will soon be merged with the Syracuse Lighting Company, Inc., according to the plans of the Mohawk-Hudson Power Corporation, which controls both companies. A petition asking that the merger be approved has been prepared and will shortly be submitted to the Department of Public Service, State of New York.

The Pennsylvania Public Service Commission heard the applications of ten small electric companies for the right of incorporation as a preliminary to conveying their rights to the Northern Pennsylvania Power Company. The companies are the Liberty, Apolacon, Middletown, Forest Lake, Jessup, Choconut and Silver Lake Township Power Companies, the Friendsville Borough Power Company, the Little Meadows Borough Power Company and the Franklin-Susquehanna Light & Power Company. In addition, eight companies already incorporated will seek the commission's approval for their sale to the larger corporation. They are the Harmony, Dimock, Brooklin, Jackson, Thompson, Hartford and Ararat Township Power Companies and the Thompson Borough Power Company.

Indiana Statute Interpreted to Commission

Interpretation of the new 1927 statute in Indiana governing appeals on the part of utilities from decisions of the Indiana county and municipal courts was given the members of the commission July 22 by Arthur L. Gilliom, Attorney-General.

In a letter to the chairman of the commission, the Attorney-General points out that it is up to the commission to accept appeals in various local courts when these appeals are filed with the commission secretary. The record and transcript in the case then must be prepared by the commission and filed in the court designated within 30 days and without further notice.

Four utilities already have taken advantage of the new law.

Utah Engineering Council Names Committee

A special committee to investigate and report on the Colorado River has been appointed by the Engineering Council of Utah, Leonard Cahoon, manager of the Stratton-Cahoon Company and president of the Engineering Council, acting as chairman.

In making the announcement of this appointment the committee made the following statement:

"The council has ordered the survey with a view to being of service to the officials of the state in connections with the problem. The committee will have no other purpose than to ascertain the exact facts and discover how the interests of the state may be best served.

"Our organization will not take any part in the present controversy. There has been too much propaganda circulated regarding the project; it is our belief that it is time for competent people, with no axes to grind, to look into the matter and make public a report on exact conditions and what Utah's interests really are. Above all, it is our paramount desire to co-operate with officials of the state in every way."

Hartford Electric Light Company Seeks Trusteeship

President Samuel Ferguson of the Hartford Electric Light Company, Hartford, Conn., a strong exponent for trusteeing the company stock, has forwarded a letter to the stockholders explaining his reasons for favoring the proceedings recommended at a recent meeting of the board of directors. He brings out in his letter that 75 per cent of the stock of the company is divided among 4,000 individuals, which he claims is a dangerous condition from a protective standpoint. Mr. Ferguson addressed letters to the stockholders in part as follows:

"In explanation I would call your attention to the change in the ownership of the company, which has been going on during the last ten years due to the greatly increased number of stockholders which we now have. Ten or fifteen years ago the control of the company rested in the stock owned by a comparatively small number of people in close contact with their representatives on the board of directors and, therefore, the ownership of the company and the management was so closely related that the prospects of the company could be known in every detail by the controlling owners, which in turn permitted the minority safely to follow their lead.

"Today that situation is completely changed. While the large stockholders still own an investment as large as or larger than formerly, the growth of the company has been so great as to permit of a large acquisition of the stock by small stockholders, so that today the board of directors and the 25 largest stockholders together own only about 25 per cent of the stock of this company, and the other 75 per cent, or far more than control, is scattered among more than 4,000 individuals.

"In other words, the control of the company is out of touch with the management and recent experience elsewhere has shown this to be a very unsafe situation. By concentrating the power of scattered stockholders in the hands of trustees who can and will be in close touch with the management, and therefore able to act with full knowledge of conditions, the present illogical and unsafe situation will be avoided.

"The trustees are the representatives of the stockholders and they can make your vote, which by itself is now ineffective, a real power for your protection through using it in conjunction with the votes of other shares. Without such an arrangement there is nothing to prevent an outside interest desiring to gain the control of the company from going over the head of the management direct to stockholders not conversant with the situation and possibly stampeding them into action which they will later regret. If you make the trusteeship effective, such action is impossible."

Commission Upheld

Appellate Court Decides Havre de Grace Service Must Be Approved in Philadelphia-Baltimore Dispute

THE contention of the Consolidated Gas, Electric Light & Power Company of Baltimore, Md., that it has the legal right to extend its service to any part of Maryland without first obtaining the approval of the Public Service Commission is denied in an opinion made public by the Court of Appeals. The decision reverses Judge Robert F. Stanton, Circuit Court, Part 2, of Baltimore city.

The opinion, written by Judge D. Lindley Sloan, embodies the court's ruling on the controversy between the Consolidated Gas, Electric Light & Power Company and the Northern Maryland Power Company, a subsidiary of the Conowingo interests, over the right to serve the city of Havre de Grace. The Appellate Court held that the Gas company must obtain the commission's permission and Judge Sloan ordered the case remanded to the lower court for a decree in conformity with the opinion of the higher court.

Claims Statewide Franchise

The Gas company contended that it could operate anywhere in the state under a "statewide franchise" granted by the Legislature prior to the creation of the Public Service Commission. Judge Sloan, however, ruled that the public service commission law, enacted in 1910, gave the commission general supervision over all public utilities.

After the lower court's decree had been made public, and while litigation before the Court of Appeals still was pending, the Gas company completed its extension to Havre de Grace and for several weeks has been supplying service to residents and operating a street lighting system. The Northern Maryland Company refused to withdraw its service and Havre de Grace has found itself being served by two companies, operating two sets of street lighting equipment.

As a result of the ruling, the Public Service Commission is confronted with the problem of determining which company is to remain in Havre de Grace.

The ruling of the Court of Appeals, H. E. West, chairman of the commission, said, appears to have clarified a situation which had become more and more involved during the last year in the "scramble" of large power utilities for territory in the state. Had the Consolidated Gas Company's contentions been upheld, Mr. West pointed out, several other power companies operating under franchises granted before 1910 could have claimed the right to extend their service anywhere in the state without the commission's approval. Had these companies undertaken such extensions, he asserted, regulation by the commission would have been virtually impossible.

In extending to Havre de Grace, officials of the Gas company said, they were attempting to round out a "natural" territory which their company should serve. At the hearing in the lower court Charles Markell, counsel for the Gas company, made a bitter attack on the Philadelphia Electric Company, which controls the Conowingo subsidiaries, alleging that it had "invaded" Maryland territory through the secret acquisition of an isolated utility.

Later the Gas company acquired the Washington, Baltimore & Annapolis Electric Railroad and extended its service almost to Washington. It has applied to the commission for permission to extend its lines through Montgomery County to a point near Great Falls, where erection of a new superpower plant has been proposed.

La Rue Quits Government Service

E. C. LaRue, head of the Pasadena branch of the U. S. Geological Survey, has resigned after 23 years of service. The reason assigned was that the government had prohibited him from advocating his opinions and beliefs with reference to the Colorado River. La Rue is a recognized authority on the Colorado River and its water problems and was called to Washington before the congressional committee investigating the Colorado River following attacks on the Boulder Canyon project, which he styled as extravagant and not as practical as others which he outlined.

He is the author of a plan involving a dam at Glenn Canyon to bring water to southern California by gravity flow and which he says would pay for itself in 40 years. He also favored the Topock project for flood control, which he estimated could be carried out at a cost of $15,000,000, and the Haulpai project, 50 miles above Boulder Canyon, for power. The Haulpai project, he declared, would furnish 200,000 hp. at low cost without the necessity of a storage reservoir.

The government having silenced him shortly after the Washington hearing, La Rue feels that his usefulness is at an end. He plans to go into the Colorado River basin for a few months; but the nature of this work cannot be divulged at present, he said.

La Rue, who is a graduate of the University of California and a native of Riverside, has made many exploration and surveying expeditions into the Colorado and its tributaries for the government since he entered the engineering service in 1904. He established survey headquarters in Pasadena in 1917, after several years as district engineer of the U. S. Geological Survey, with headquarters at Salt Lake City. In 1925, after years of study and investigation, he submitted a complete report on the possibilities for the development of irrigation and power on the Colorado.

Canada Delays St. Lawrence Treaty

Prime Minister in Answer to American Proposal for Joint Agreement Seeks Additional Engineering Data from the Canadian Committee

WASHINGTON'S proposal that the governments of Canada and the United States confer on the proposed seaway through the Great Lakes and St. Lawrence River cannot be taken up at this time by the Dominion authorities, it was disclosed in an exchange of notes made public at the State Department. Canada asks postponement for the completion of the project until further engineering data are furnished by the Canadian advisory commission, which is still studying the economic and general aspects of the waterway question.

In a note handed to the Canadian Minister, Vincent Massey, by Secretary of State Kellogg April 13, Canada was informed of this government's readiness to begin negotiations for a treaty or convention covering the joint cost of constructing the proposed waterway. In Canada's answer, transmitted July 12 by W. L. MacKenzie King, Prime Minister, the point is made that Canada's study of the question is incomplete. At a later date the Dominion authorities will be prepared to take the subject up, he says.

United States Ready

Asserting that a joint board of engineers made an elaborate resurvey of the lake and river systems both as to navigation and power, and filed with each government an exhaustive report upon all its engineering aspects, Secretary Kellogg said:

"The government of the United States adopts the recommendations of the St. Lawrence commission. It appreciates the advantages which will accrue equally to both countries by the opening of the waterway to ocean shipping. It feels that the necessary increase in railway rates due to the war and the modern practices respecting the generation and transmission of hydro-electric power have increased the importance and practicability of early development, and believes that the factors which influence its conclusions must have equal application to, and influence upon, the Dominion of Canada. This government is prepared to enter into negotiations with a view to the formulation of a convention appropriate to this subject and should be grateful to be informed of the views entertained on this subject by your government."

Canada Awaits Final Report

In his reply the Prime Minister of Canada makes this point:

"The report of the joint board of engineers signed on Nov. 16, 1926, while unanimous in many respects, indicated differences of opinion on important phases of the development proposed. It is understood that in the appendices to the report, which are in preparation, certain further alternative schemes will be presented which will be of essential value in arriving at a conclusion.

"The national advisory committee appointed by the government of Canada to report on the economic and general aspects of the St. Lawrence waterway question will not be in a position to make a final report until all the findings of the joint engineering board, including the appendices, are available. Upon receipt of the report of the national advisory committee and upon consideration of the other factors involved the government of Canada will be able to determine its policy on the question, and will then have pleasure in discussing further with the government of the United States at as early a date as possible the whole situation."

Pennsylvania Contract

Railroad Contracts with Philadelphia Electric Company for Twenty-Year Supply of Electricity

THE Pennsylvania Railroad has signed a contract to purchase all electricity needed for its lines during the next twenty years or more from the Philadelphia Electric Company, it is announced by W. H. Johnson, president of the latter organization.

"The railroad agreed in the contract to purchase energy, in addition to its present requirements, for the electrification of the Philadelphia and Wilmington and the Philadelphia and West Chester divisions of its system," Mr. Johnson announced.

"The contract covers a minimum term of twenty years, and not only provides for the present electrification, its proposed extension—as outlined above—but also for all future electrification upon its lines in this territory.

A New Era

"The signing of this contract, which we understand to be the most important ever executed between a railroad and a public utility, means a new era in railroad electrification. At the present time, the Pennsylvania Railroad system has three electrified divisions—Chestnut Hill, main line to Paoli and the West Jersey & Seashore to Atlantic City—the energy for all of which is being supplied by the Philadelphia Electric Company.

"It is a source of great satisfaction to our company that one of the determining factors back of the signing of this contract by the railroad was the adequate and reliable service which has been provided to it since the electrification of the main line thirteen years ago.

"Some time ago the Pennsylvania Railroad announced its plans for the new station in West Philadelphia, with electric suburban service into Broad Street. The Pennsylvania System has been a leader in the matter of establishing the conveniences and economies which go with railroad electrification."

The energy will be generated by the electric company at 60 cycles and supplied to the railroad at 13,200 volts, 25 cycles, single phase. Most of the power, of course, will come from Conowingo.

The Pennsylvania Railroad already has electrified 60 miles of its lines in New Jersey, 12 to Chestnut Hill, 20 on the main line and 6 on the Fort Washington branch to Whitemarsh. The exact total is 102.9 miles. Preparations now are being made to electrify the lines of Wilmington and West Chester.

Test Dam to Be Heightened

The National Arch Dam test committee of the Engineering Foundation met in Los Angeles, July 20. The committee was optimistic relative to the possibilities of raising the $50,000 necesary to carry on the construction of the arch dam to the point where it will collapse and thereby provide a maximum of engineering data relative to the possibility of this type of dam structure. It will issue its report on the test made thus far and will have it in the hands of those sponsoring the project within a few months.

The dam now stands at 60 ft. and has successfully withstood a full head of water back of it. Plans of the committee in charge of the work call for raising the dam to a height of 100 ft. Those in attendance at the meeting included Alfred D. Flynn, director of the Engineering Foundation of New York; W. A. Slater of the U. S. Bureau of Standards of Washington, D. C.; D. C. Henney, a consulting engineer from Portland, Ore.; Charles D. Marx, from Stanford University; H. W. Dennis, Southern California Edison Company; H. Hawgood and Fred A. Noetzil, consulting engineers of Los Angeles.

Harnessing Ohio's Falls

Before Year Ends Louisville Hydro-Electric Company Expects to Generate 135,000 Hp. at Federal Lock

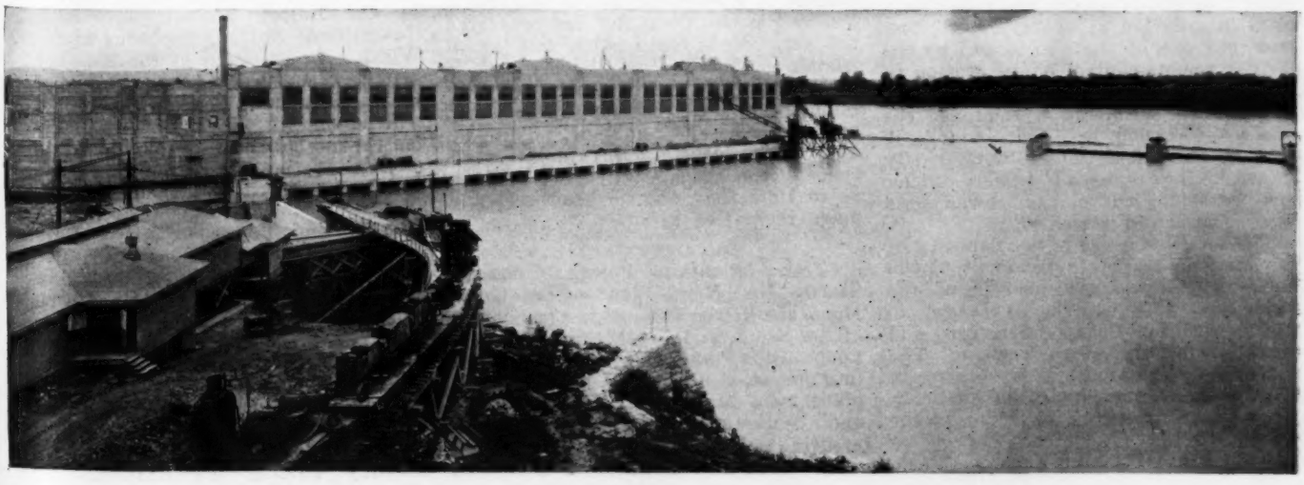
BARRING unexpected delays, the Louisville Hydro-Electric Company will be ready to start generating 135,000 horsepower through its hydro plant on the Falls of the Ohio by December next. This new plant will produce power, it is estimated, for a total of ten and a half months of the year, and its output added to the present steam-produced power from the Louisville Gas & Electric Company's Riverside plant will give the latter and parent company 260,000 hp. of available electricity. Room for a steam auxiliary at this new shipping port hydro plant has been provided, and in addition the company's lines are interconnected with those of the Kentucky Utilities Company, with which it can therefore exchange energy as conditions dictate.

With all of the surplus power that is going to be available later on, the company needs customers, and it has been campaigning for establishment of large industries at Louisville. It is quoting contract rates which it says compare favorably with the lowest quoted at Niagara or Keokuk. The company has doubled its electric output on an average every four years for the last twelve years. Its public relations have also been excellent, and one out of every five customers is a stockholder.

The combined power and navigation dam will cost around $3,000,000, and the power plant something over $7,000,000, making an investment of more than $10,000,000. The federal government is erecting the dam, which will raise the river stage for many miles above Louisville, improving navigation in line with the 9-ft. stage plan.

Many thousands of visitors have gone over the new hydro plant, work on which was started in the fall of 1925. The power dam is L-shaped, 8,650 ft. long, having a Chanoine pass to permit boats to go through in high water, when the locking system is impracticable, and also a Boule dam to control flow of water. The fall here was but 25¼ ft. in 3 miles, but by raising the dam 9 ft. a head of 37 ft. was possible.

The power house, where machinery is now being installed, is on the Ken-



PRESENT STAGE OF CONSTRUCTION OF HYDRO-ELECTRIC DEVELOPMENT AT FALLS OF THE OHIO

tucky side of the river, with the Louisville and Portland Canal separating it from the mainland, it being on an island. The building is 534 ft. long and 74 ft. wide and will contain eight units, of 13,500 hp. each, or a total installation of 108,000 hp., with provisions made for installing mechanical equipment for two more units when needed. The steam-power plant which will adjoin the hydro-electric plant may be started in 1929 and will be erected with the idea of an ultimate capacity of 250,000 hp. The plants are connected with the mainland by a bridge for vehicles as well as a swinging railroad span and will be able to obtain coal and supplies by rail or water at will.

Geological Survey Report on the Payette and Elwha

The Interior Department, through the Geological Survey, has recently completed a survey of the Payette River, Idaho, from Banks to Horseshoe Bend, North Fork to Cascade, South Fork to Grand Jean and Deadwood River through Deadwood Basin, also of several large reservoir sites within the basin. In addition, field investigations of the power and storage possibilities were made. A report by W. G. Hoyt, hydraulic engineer, based upon these surveys and investigations, indicates that there are at least twelve reservoir sites within the basin, which have a combined capacity of 1,200,000 acre-feet. Besides the storage sites the report describes 25 power sites at which it would be possible to develop somewhat over 100,000 hp. during low-water seasons. By means of storage the potential power could be materially increased. The capacity of the individual sites ranges from 4,000 hp. to 5,000 hp. at low water, and it is expected that this may be developed gradually as the demands of the mining industry and of public utilities increase. This report, which is in manuscript form, may be examined at the office of the Geological Survey, in Washington, D. C.; Boise, Idaho, and Salt Lake City, Utah.

A report on the power resources of the Elwha River, which drains part of the Olympic Range in the State of Washington, has also been prepared by the Geological Survey. This report indicates that the Northwestern Power & Manufacturing Company is now operating two plants on the river having a total installation of nearly 16,000 kva. and that one of the plants will be the largest remote-control power station in the United States. Two reservoir sites were surveyed having a combined capacity of 75,000 acre-feet, which, if used to store floodwaters, will greatly increase the potential power during low water. Undeveloped power sites were located and described.

The total potential power capacity of the river is stated to be about 47,000 hp. during low-water periods of the year, and this can be increased to 81,000 hp. by the construction and operation of the storage sites. The surveys and examinations were made in 1926 by E. E. Jones, hydraulic engineer. His report is open for inspection at the offices of the Geological Survey at Washington, D. C., and Tacoma, Wash.

Briefer News

Seattle's New Lighting Standards.—A program of street lighting in the central business district of Seattle, to cost, it is asserted, in excess of $1,000,000, has been started by the city. The installation will consume approximately a year's time. A specially designed and attractive standard has been selected and will be known as the "Seattle pole." It is made of cast bronze filled with concrete, will carry three globes placed in an oblique row, and is 22 ft. high to the middle light center. The wiring will be for 1 kw. to 2 kw. per globe, according to the location.

Public Service of New Jersey to Have New Office Quarters.—The Public Service Corporation of New Jersey has demolished its old office building on East Park Street, Newark, and an extension to its headquarters building to cost $2,500,000 will begin at an early date. The building will contain fourteen floors. The East Park Street front will be faced with limestone. Bridges will connect the north and south wings at the eighth and ninth floor levels. With the erection of this building the floor space of the company's offices at Newark will be increased by 97,300 sq.ft. The building is expected to be ready for occupancy by October, 1928.

Defiance (Ohio) to Vote on Electric Plant.—The citizens of Defiance, Ohio, will vote on Aug. 9 on the question of building a municipal electric plant. The City Council, which favors the plant and has already voted $405,000 for its construction, is opposed by a large number of citizens who have organized the "Citizens' Rights Association" in an effort to beat the Council at the polls. The Council has been petitioned by 1,200 voters who ask that, instead of building a plant, further efforts be made to compromise the differences with the Toledo Edison Company. Moreover, a "business ticket," which is backed by the Republican party, has been placed in the field committed to dealing further with that company.

Wisconsin Company Presents Two Islands to Community.—The Wisconsin Valley Electric Company has presented the city of Wausau with two small islands in the Wisconsin River. One is Stack Island, which lies west of Oak Island, now the property of the city, and the other is unnamed. The two islands are considered valuable additions to the Wausau city park system, as in time they can be beautified and made recreation grounds.

Green Mountain Power Company Starts Up New Plant.—The Green Mountain Power Company, a subsidiary of the People's Hydro-Electric Vermont Corporation, has completed and put into operation a 7,500-hp. hydro-electric plant near Marshfield, Vt. An earth and concrete dam was constructed, creating a lake approximately 2½ miles long, from which water is conveyed about 1¼ miles to the generating plant 385 ft. below the lake. This is said to be the highest "fall" in Vermont. Energy is transmitted over a 33,000-volt line which ties in with the company's main system supplying Montpelier, Barre and thirty other towns. At present seven other hydro-electric plants and one 7,500-kw. steam generating station are feeding this interconnected system.

Eugene (Ore.) Votes for New Municipal Generating Plant.—Voters of Eugene, Ore., have approved the plan to build a hydro-electric plant on the McKenzie River, to supplement the existing municipal plant, which has become inadequate. For several years the city has purchased additional power from the Mountain States Power Company's plant at Springfield, across the river. The first unit of the proposed plant, which is to be installed as soon as possible, will bring the total rating of Eugene's plants to 16,000 hp. Two other units are contemplated. Bonds in the amount of $1,250,000 were authorized.

Mississippi Electric League Meets at Gulfport.—Between three and four hundred delegates from Mississippi, Alabama and Louisiana attended the annual meeting of the Mississippi Electric League at Gulfport, Miss., last week. There were group conferences of central-station men, manufacturers and jobbers, contractors and dealers, and the women's section. Among the speakers were President E. E. Armstrong, W. R. Herstein of Memphis, Dr. James S. Thomas of the University of Alabama and Miss Miriam Freidman of Birmingham.

Rate Reductions in Twenty-nine Oklahoma Cities.—At least $85,000 a year is expected to be cut from the consumers' bills of the Public Service Company of Oklahoma by the voluntary reduction of electric light and power rates by that company. Tulsa and twenty-eight smaller places in the eastern part of that state are affected. Rates for domestic consumers are now based on the number of rooms in each residence. Commercial users will have a rate based on maximum demand.

Boston Edison Organizes for Industrial Expansion. — An industrial development division has been established by the Edison Electric Illuminating Company of Boston, in charge of J. M. Whittier, a graduate of the Massachusetts Agricultural College and of the Harvard Business School. The division will co-operate with chambers of commerce and business development committees in the more than forty cities and towns served by the company.

Light and Power Company Enters New Field.—Announcement is made that the Cheyenne (Wyo.) Light, Fuel & Power Company has obtained a contract as lowest bidder for the construction and maintenance of beacons to guide air-mail pilots flying between Cheyenne, Wyo., and Pueblo, Col., a distance of about 200 miles. The Cheyenne company is a subsidiary of the Cities Service Company, the Henry L. Doherty holding organization. The

contract calls for boundary lighting on five fields and the building of twenty 50-ft. towers, of which fifteen will hold 24-in. searchlamps and five will hold blinker lights. The lights will be visible about 25 miles. The fields are about 30 miles apart, and each field will be outlined with thirty-one lights. The blinker lights will be operated by sun dials, going on and off as the sun sets and rises.

Interconnection Closes Municipal Generating Plant in England.—Shipley, in the West Riding of Yorkshire, England, is one of the first local municipal "authorities" to follow the advice of the British Electricity Board to close down smaller generating stations in favor of bigger ones supplying a larger area. The town's generating station, after 26 years, has been superseded, and electricity more economically produced will be supplied from the superstation of the Yorkshire Electric Power Company. Electricity will be generated by steam turbines with 100 times the output of the older plant, and nearly 10,000 tons less coal will be burned each year.

Floodlighting Stone Mountain, Ga.—Plans for a 3,000,000-cp. airway beacon and the floodlighting of the mountainside and the great Confederate memorial on Stone Mountain, Ga., have been completed and the illumination equipment will be installed before long. The beacon is to be placed on the top of the mountain by the United States government as part of a system of airmail route markers and will, it is said, be visible for 40 miles. The lighting of the mountainside is a private enterprise. It is probable that the Georgia Power Company will supply the electricity for this project.

Seven Railroads Order Gas-Electric Cars.—More than a score of combination passenger, baggage and mail Brill-Westinghouse gas-electric cars have been placed under contract by seven different railroad companies, including the Alaskan line operated by the Department of the Interior, according to an announcement made by Thomas Cooper, manager of the transportation division of the Westinghouse Electric & Manufacturing Company. The cars will range in length from 60 ft. to 73 ft. and will be equipped with a power unit of 250 hp. The orders for the new cars, which total about $1,000,000 in value, include four for the Baltimore & Ohio Railroad, eight for the New York Central, including one car with a double-power unit, giving it a total of 500 hp.; six cars for the New York, New Haven & Hartford, two for the Central Railroad of Vermont, and one car each for the Atchison, Topeka & Santa Fe, the Lehigh Valley Railroad and the Alaskan Government Railway. The last, which has been designed to operate under extremely severe weather conditions, will be run from Seward to Fairbanks via Anchorage, a distance of 945 miles of rough traveling, consuming four days for the round trip. Since August, 1925, according to Mr. Cooper, approximately 70 gas-electric cars have been ordered by 20 railroad companies, representing a total investment of almost $3,000,000.

Recent Court Decisions

Ordinary and Reasonable Care All That Is Necessary in Maintaining High-Voltage Wires in Street.—Damages were awarded plaintiff in Morgan vs. Cockrell because of the death of a workman who picked up a very long iron rod to aid him in his work and was instantly killed when the end of this rod struck a 2,300-volt uninsulated wire strung 15½ ft. above the street and 5 ft. from the door of the boiler room where he worked. This finding has been reversed by the Supreme Court of Arkansas, which holds that the owner of the transmission line was under obligation to exercise only ordinary and reasonable care, that he was not required to insulate all its wires, and that it was a reversible error for the trial judge to refuse to instruct the jury that if an accident such as caused the decedent's death could not reasonably have been anticipated by the defendant as the result of his method in erecting and maintaining wires, then the verdict should have been for the defendant. Other reversible errors were the refusal of an instruction that the defendant was not an insurer of safety to persons in the vicinity of its street wires and the refusal of an instruction denying recovery if the injury was due solely to accident. (294 S. W. 44.)*

Canadian Court Denies Recovery for Alleged Interference of Dam with Timber Floating. — The Kaministiquia Power Company, Limited, and the Hydro-Electric Power Commission of Ontario have won an appeal from a judgment in a suit brought against them by John Sterritt & Sons, Limited, for damages amounting to $476,535. The power company has a plant on the Kaministiquia River near Big Dog Lake with provincial right to develop power. It was alleged by John Sterritt & Sons that the power company usurped and kept control of the waters, thus preventing the plaintiffs from floating their timber. The trial judge had held the power company liable for loss and damages. The Hydro commission was interested in the case through having ownership of a dam at that point operated by the power company. The Canadian appeal court found that the plaintiff company was itself largely responsible for the preventing of higher water in the lake. It also found that it had not been established that the power company drew down the water in the lake lower than it was entitled to do.

Commission Control Not Confined to Public Streets and Places.—In finding invalid an order of the New York City fire commissioner requiring the installation of an automatic gas shut-off valve of one of three types, because it required the use of a patented article without opportunity for competition, the New York Supreme Court, Appellate Division (Polsky vs. Walsh), made the observation that the control of the Public Service Commission of the state is not confined to public streets and places. In support of this dictum it quoted a finding of the Appellate Division in Oneonta Light & Power Company vs. Public Service Commission (167 N. Y. S. 486) as follows: "The proposition that the construction and operation of a lighting system by an electrical corporation is beyond the supervision of the Public Service Commission so long as the electric current is sold and distributed upon private property contravenes some of the most important purposes for which the Public Service Commission was created and given supervision of this class of public utilities—viz., the protection of the public from improper and dangerous construction." (222 N. Y. S. 120.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Wishes of Community Concerning Sale of Local Plant to Large Company Entitled to Consideration. — Authority to sell a local electric plant to an outside power company has been denied by the North Dakota Board of Railroad Commissioners in a case where the seller manifested an apparent desire to continue the operation of the plant and to be relieved of his obligation to sell, while the community was virtually unanimous in opposing the transfer. The commission said: "Without the united co-operation of the city and the inhabitants thereof a public utility cannot long continue to render efficient service at reasonable rates. If the city prefers to be served by a local company and such company is found able to serve that community adequately, undoubtedly the wishes of the community should be consulted."

Principles of Valuation for Establishing Rate Base.—In evaluating water utility property to be acquired by the city of Marysville, the California Railroad Commission laid down several principles as governing its conclusions, among which were the following: No great weight can be given to the assessed value of utility property for taxation purposes in proceedings to fix just compensation to be paid by a city, particularly when the person who actually made the appraisal is not produced for examination and cross-examination as to the methods followed and items included in his appraisal. An estimate of reproduction cost new is not the final measure of fair value for the purpose of municipal acquisition, but it is merely one of the methods used to assist the commission in arriving at such a value. The segregation of the various component items of equipment and structures into those perishable and those imperishable would not only be impracticable but would result in the utmost confusion. To the extent that a system is partially inadequate, weight must be given to shorter life of property, and so far as reasonable to the factor of inadequacy.

Men of the Industry

Lucas and Peterman Made Executives of Southern Company

John Paul Lucas of Charlotte, N. C., and R. L. Peterman of Columbia, S. C., have been made vice-presidents of the Southern Public Utilities Company, Charlotte. Mr. Lucas has been connected with the Duke interests for more than eight years, concentrating especially on public relations work. In 1922 he was temporarily released in order to devote his time to a "Live-at-Home" campaign then being conducted in North Carolina. The purpose of the movement was to bring before the farmers of the state the grievous effects of failure on their part to grow at home food needed by their families and livestock. So successfully did Mr. Lucas handle the publicity for the campaign that the joint committee for agricultural work passed a resolution thanking him for his efforts.

Mr. Peterman has been connected with the General Gas & Electric Corporation and its subsidiary companies for the past twelve years. He was located at Greensboro as vice-president of the North Carolina Public Service Company, then at Spartanburg, S. C., with the South Carolina Gas & Electric Company, and at present at Columbia, S. C., where he has been connected with the Broad River Power Company.

C. H. Bell, for the past two years superintendent of the municipal light and power plant at Watertown, S. D., has resigned.

Dean Wilkins, district engineer of the Public Service Company of Northern Illinois at Waukegan, has been transferred to the Chicago Heights district.

Thomas S. Cowen, power engineer for the New York State Gas & Electric Corporation at Ithaca, has been transferred to the Walton office to take care of the new power business in the Delaware and Sullivan County districts.

Harold B. Walker of Nashville is a recent addition to the personnel of the industrial department of the Tennessee Electric Power Company. Mr. Walker was formerly connected with the Dupont Rayon Company at Nashville, and previous to that affiliation had several years experience in different lines of industry that peculiarly fit him for this new work.

George H. Shaw, special counsel for the Public Service Company of Colorado, has been named general counsel, succeeding Rodney J. Bardwell. It was Mr. Shaw who engineered the ways and means for securing the twenty-year franchise for the company from the city of Denver in the May, 1927, election.

David J. Brown has been appointed purchasing agent of the Adirondack Power & Light Corporation to succeed W. L. Fellows, resigned. Mr. Brown joined the Adirondack organization in 1923 as assistant to the construction superintendent and more recently was appointed in charge of transportation activities. This position he still retains in addition to his new assignment as purchasing agent. He was previously identified with the F. T. Ley Company of Springfield, Mass., engaging in power-plant and transmission construction.

E. A. Davis New Chairman of Accounting Section, N.E.L.A.

The election of E. A. Davis as chairman of the Accounting National Section of the National Electric Light Association for 1927-28 follows a period of years of activity in various branches of the association. Mr. Davis' activities have included the chairmanship of the accounts payable committee and membership on the classification of accounts committee, the educational committee and the executive committee of the Accounting National Section. Last year Mr. Davis was vice-chairman of the Accounting National Section.

E. A. Davis

Mr. Davis is a Canadian by birth. He was born in Nova Scotia in 1884 and moved with his parents to Fall River, Mass., three years later, where he attended public school. His first public utility position was with the Fall River Gas Works Company, his duties embracing office work, reading meters and delivering bills. He became assistant treasurer of the company under the management of Stone & Webster at Baton Rouge, La., in 1907, and in 1910 moved eastward again to Woonsocket, R. I., as assistant treasurer of the Stone & Webster properties there. The succeeding six years he spent outside the utility field, acquiring accounting experience in other lines of business. He returned to public utility accounting in 1916 with the subsidiary companies of the Middle West Utilities Company in Oklahoma. In November, 1920, Mr. Davis was appointed auditor of the Middle West Utilities Company with headquarters at Chicago.

W. K. Simmons, formerly of Boonville, Mo., who has been manager of the rural service department of the Kansas Light & Power Company at Topeka, was recently named manager of the Clinton (Mo.) plant of the Missouri Power & Light Company to succeed **William E. Bradley,** who becomes gas and electric appliance sales manager of the company, with headquarters at Excelsior Springs.

Robert W. Waite, formerly auditor of the Utility Securities Company, Chicago, has been elected vice-president and treasurer of the company. Mr. Waite also serves on the board of directors.

Charles S. Masson has resigned his position as illuminating engineer for the Southern California Edison Company to organize the lighting service department of the Forve-Pettibone Company, Los Angeles. Mr. Masson had completed fifteen years of service with the Edison company when he resigned.

J. D. Whittemore Receives New Honor

J. D. Whittemore, who recently joined the Mohawk-Hudson Power Corporation in a general engineering capacity, as announced in the July 9 issue of the ELECTRICAL WORLD, has been elected president of the Eastern New York Utilities Corporation, Rensselaer, N. Y. Before removing to Albany Mr. Whittemore was vice-president and general manager of the Monongahela West Penn Public Service Company.

Edward R. Grier, president of the Arrow Electric Company, Hartford, Conn., has been elected a director of the Bankers Trust Company of Hartford, Conn.

Edwin Vennard has been appointed general commercial manager of the Southwestern Gas & Electric Company, Texarkana, Ark., in charge of all merchandising activities and power sales.

Major Henry L. Jennings, assistant patent attorney at the South Philadelphia works of the Westinghouse Electric & Manufacturing Company, has resigned his position to enter the practice of patent law with R. D. Johnston at Birmingham, Ala. He will assume his new duties shortly. In the early part of his career Major Jennings was actively engaged in engineering work. Four years ago he affiliated himself with the Westinghouse company as assistant patent attorney at South Philadelphia.

Donald A. Henry, for the past twelve years connected with the engineering staff of the Illinois Commerce Commission, has resigned to become affiliated with the Utilities Power & Light Corporation with headquarters in Chicago. Mr. Henry has filled various positions while with the commission, for the last six years having been in charge of electrical and electric railway investigations. Previous to his connection with the commission he had been in the operating department of the Illinois Traction System, the Sanitary District of Chicago and the East Pittsburgh factory of the Westinghouse Electric & Manufacturing Company. In his new position, the duties of which he will assume on Aug. 1, he will handle commission cases, rates and appraisals for

the Utilities Power & Light Corporation and its subsidiaries. Mr. Henry is a graduate of the University of Illinois, having also a professional degree from that institution. He is a member of the American Institute of Electrical Engineers and a vice-president of the Springfield Engineers Club.

A. H. Siegfried has resigned his position as district engineer in the Republic of Mexico for the Worthington Pump & Machinery Corporation to become general superintendent for the Abastecedora de Luz, Fuerza y Agua in Mazatlan, Sinaloa, Mexico.

John Murphy, electrical engineer of the Canadian Department of Railways and Canals, has been chosen president of the Canadian delegation to the International Electrotechnical Commission. He succeeds the late president, James Kynoch, who was chief engineer of the Canadian General Electric Company and who died on June 1.

H. C. Rice, who has been acting head of the merchandising department of the Southern California Edison Company since R. I. Carruthers, the former manager, was injured in an automobile accident last July, has been made manager of the department.

H. T. Wilson, formerly with the Clinton (Iowa) Gas & Electric Company, has been appointed manager of the Minnesota Electric Light & Power Company at Bemidji, succeeding A. P. McDonald. Mr. McDonald has removed to Greenville, Ohio.

D. G. Tyree, until recently assistant secretary of the California-Oregon Power Company, has been made manager of the newly established investment department. Before entering public utility work in 1924 he served as assistant district counsel in the United States Reclamation Service at Phoenix, Ariz., Los Angeles and Portland, Ore. He resigned the latter position in 1920 to become assistant to the general manager of the California-Oregon Power Company.

Harry C. Coleman, marine engineer of the general engineering department of the Westinghouse Electric & Manufacturing Company, has been promoted to be manager of marine engineering to fill the vacancy created by the appointment of Walter B. Thau as director of marine engineering. Mr. Coleman was graduated from Ohio State University in 1916. Since his affiliation with the Westinghouse company, which followed graduation, he has specialized in marine work.

A. L. **Broomall**, formerly renewal-parts engineer for the Westinghouse Electric & Manufacturing Company, is directing these activities at both the Homewood and the East Pittsburgh works in the capacity of manager of the renewal-parts engineering department recently organized. **C. L. Fortescue** has been appointed consulting transmission engineer. He will concentrate his attention principally upon more fundamental problems of electrical transmission lines in general and will have a consulting relationship with engineering in other departments. **G. M. Barrow**, who has been connected with the Derry (Pa.) works, has been appointed manager of engineering there.

C. I. Weaver New President of East Central Division

C. I. Weaver, who was elected president of the East Central Division of the National Electric Light Association, as announced in the news columns of the ELECTRICAL WORLD last week, has been vice-president and general manager of the Ohio Edison Company, Springfield, Ohio, since 1924 and prior to that served in the same capacity for the Springfield Light, Heat & Power Company from 1918 to 1924.

A graduate electrical engineer from Kansas State College in 1906, Mr. Weaver has since then been associated with the electrical industry, first in the testing department of the General Electric Company at Schenectady and later in its sales department. In 1909 he became manager of the electrical department of the Marshall-Wells Hardware Company, Duluth, Minn., and from 1910 to 1912 was connected with the Chicago office of the Westinghouse Electric & Manufacturing Company. In

C. I. WEAVER

1912 Mr. Weaver became sales manager for Hodenpyl, Hardy & Company at Jackson, Mich., and from 1915 until 1918 was manager of the Eastern Michigan Power Company, the construction company for the Consumers Power Company of Michigan. Mr. Weaver has been closely connected with utility association work and lately has taken an active interest in the development of farm electrification.

E. L. Crowe, formerly mechanical engineer with the Sessions Engineering Company, has joined the staff of the Joseph Harrington Company, a subsidiary of the Whiting Corporation, as sales engineer. Mr. Crowe is affiliated with the Chicago office of that organization.

J. B. Rogers, formerly manager at Nevada, Mo., for the Missouri Power & Light Company, has succeeded S. W. Henderson as manager for the company at Excelsior Springs, Mo. Mr. Henderson, who for eighteen years was connected with the public utility industry in Missouri, resigned in April. The new Excelsior Springs manager is a native of London, England, and was educated there, studying mechanical and electrical engineering at Sheffield University. He came to the United States in 1905 to fill a position in the installation department of the General Electric Company. Later he was manager for the water, gas and electric property in Franklin, Ind., and subsequently was in charge of operation of the La Crosse (Wis.) Water & Power Company. Following that connection he was appointed manager of the Idaho-Oregon Light & Power Company, with headquarters at Boise, Idaho. During the past nine years he was manager for the water, gas, electric and heat utilities in Nevada, Mo.

Ralph U. Fitting, formerly associated with the firm of Parsons, Klapp, Brinckerhoff & Douglas, consulting engineers in New York, and for the last three years in the valuation department of the Pacific Gas & Electric Company, San Francisco, has been made the valuation engineer of the Los Angeles Gas & Electric Corporation, Los Angeles.

J. G. Longsvorf of Reading, Pa., has been appointed representative of the industrial department of the Southern Cities Power Company in the East with offices in New York and Philadelphia. Mr. Longsvorf will assist in obtaining new industries for middle Tennessee.

E. L. Crump, merchandise manager for the Tennessee Electric Power Company at Murfreesboro for the past year, has assumed new duties in the company's industrial development department. Mr. Crump is a native of Memphis and a graduate of the University of Tennessee in electrical engineering. He spent a year and a half in the testing department of the General Electric Company at Schenectady and three months in study and test work on commercial and industrial illumination work, part of the time being located at the Edison Lamp Works at Harrison, N. J. It was in the fall of 1924 that he entered the Cleveland (Tenn.) office of the Tennessee Electric Power Company as sales engineer.

E. M. Hewlett has been appointed consulting engineer of the switchboard department of the General Electric Company. Mr. Hewlett has been engineer of the switchboard department since its formation and will be succeeded in that capacity by **E. B. Merriam**. The number of assistant engineers has been increased to three by the appointment of **Chester Lichtenberg**, with headquarters at Philadelphia. Other changes in the switchboard engineering organization include the appointments of **W. K. Rankin** as assistant designing engineer with headquarters at Schenectady and **G. E. Stewart** with the same title but making his headquarters at West Philadelphia.

Percy H. Whiting, who for nearly ten years has been active in customer-ownership work for various electric and gas companies, has left Henry L. Doherty & Company, where he was first manager of the customer-ownership division and later general retail sales manager, to form his own organization, P. H. Whiting & Company, Inc., with a main office at 1 Wall Street, New York, and a branch office in Newark. Mr. Whiting has been a member of the customer-ownership committee of the National Electric Light Association since its organization and has been a frequent speaker and writer on customer-ownership subjects.

Financial and Statistical

Common Stocks Inactive
Funds Are Plentiful
Some Issues Remain Unsold

STOCK market leaders in the industrial and motors fields have called for so much attention this week that utility stocks as a group have largely been neglected, except for such issues as American Water Works & Electric common, which reached a new high, and a few other issues. Power and light securities on the curb and over-the-counter markets have attracted little interest.

On the surface, at least, the old economic law of supply and demand seems to have been disproved by the rather unusual situation in the money and security markets. Apparently there is a great abundance of funds available, yet the rate of absorption of certain recent security issues has been exceedingly disappointing. This applies more particularly to other than public utility issues, but affects the entire market.

There are two or three factors bearing on the situation. One is the difference between the availability of short and long-term funds. Midsummer slackness in many lines of business has released funds to such an extent that money rates are lower than they have been for some months. This, however, affects the long-term market only indirectly. There is evidently less long-term investment money available and, furthermore, as suggested by an investment man who knows from first-hand experience, some recent issues were put on the market at slightly too high a price, at least in the opinion of the investing public.

One must also consider the unusually large volume of financing that has been carried on this year so far. Total public financing of the first half year was almost $5,300,000,000. Of this more than $4,100,000,000 was new money, against $3,580,000,000 the first half of last year. In other words, market requirements of the first half of 1927 exceeded those of the first half of 1926 by more than half a billion dollars.

May Returns Show Continued Increase in Central-Station Business

Output Increased 13.1 per Cent—Highest Gain of the Year—Daily Revenue $4,540,000—Southwest Active

AN INCREASE of 13.1 per cent in energy output and 11.4 per cent in revenue is shown by returns received from central-station companies by the ELECTRICAL WORLD for May, 1927, compared with activities for the corresponding month last year. The estimated revenue for the entire industry in the United States was $140,900,000, the output 6,152,097,000 kw.-hr.

The seasonal decrease in energy consumption which is evident in every normal year as the days lengthen has been unusually small this year, the average daily output for May falling only about 3 per cent under that for December.

The exceptional activity that had marked 1926 abated slightly toward the end of the year; the winter peak was distinctly flattened. In the spring of 1926 the usual seasonal droop had, on the contrary, been a little steeper than usual, whereas this spring it was less than usual.

Consequently comparison of the gain in energy output between the two years shows a growing excess, month by month, from 9.9 per cent in February to 13.1 in May. The revenue has apparently followed at an interval of a month as might be expected. The March earnings were 9.4 per cent above those in the previous year; April gains were higher, 10.0 per cent, and May, 11.4; June returns are not yet available, but on the basis of the May energy output ought to be still farther above those for June, 1926.

As usual the two divisions of the country having the largest energy output are the Middle Atlantic and East North Central States; the greatest percentage gain over May of last year, however, took place in the West South Central States, notably in Oklahoma. In the Southeastern group also the growth has been rapid, averaging around 20 per cent; New England, which earlier in the year was progressing but slowly, is now nearly up to the

TABLE I—OPERATING RATIO OF CENTRAL-STATION COMPANIES

	Operating Ratio					
	Steam Plants		Hydro Plants		Combined Hydro and Steam Plants	
	1927	1926	1927	1926	1927	1926
Feb.	42.7	42.2	37.4	36.5	39.6	40.8
Mar.	45.2	44.9	37.9	36.1	42.4	44.2
April	44.8	44.7	37.4	35.8	39.5	39.9
May	47.9	48.4	40.3	38.2	42.2	43.4

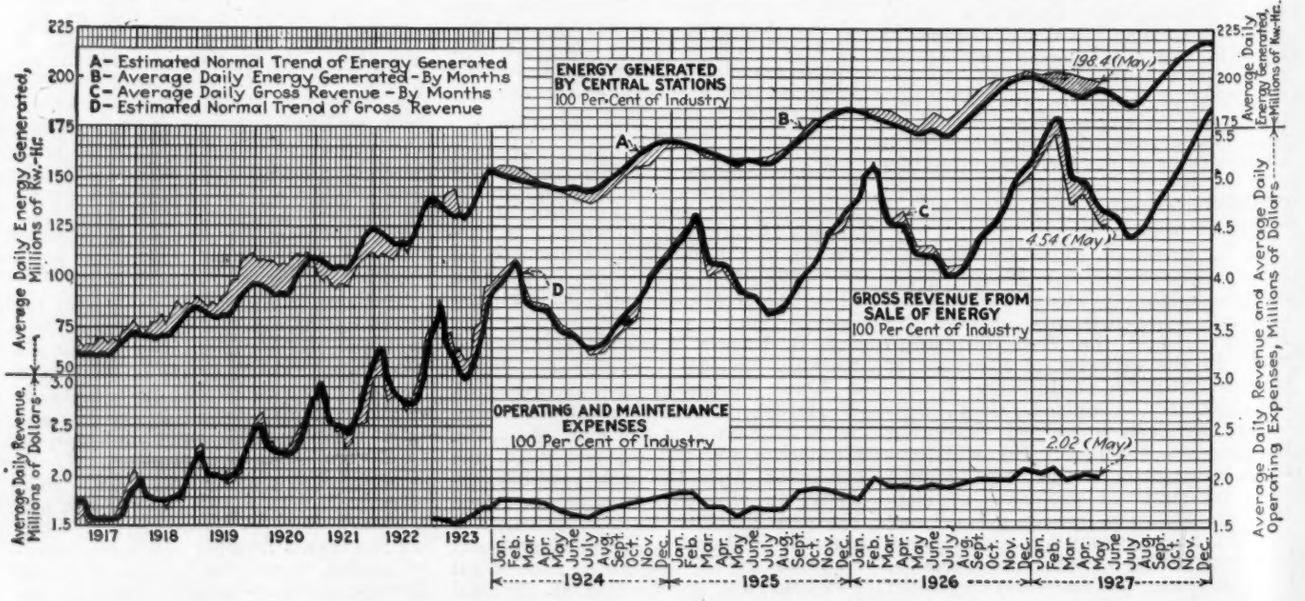

A- Estimated Normal Trend of Energy Generated
B- Average Daily Energy Generated - By Months
C- Average Daily Gross Revenue - By Months
D- Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
198.4 (May)
4.54 (May)
2.02 (May)
Average Daily Energy Generated, Millions of Kw.-Hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
1917 1918 1919 1920 1921 1922 1923
1924 1925 1926 1927

TABLE II—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 Per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Estimated Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.			
	1927 Thousands	1926 Thousands	Per Cent Inc.	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands
Feb....	5,706,468	5,190,645	+ 9.9	4,696,468	4,188,645	1,210,000	1,128,000	2,928,468	2,559,645	558,000	501,000	1,010,000	1,002,000	1,137,000	920,000
Mar....	6,314,272	5,727,028	+10.3	5,194,272	4,621,028	1,305,000	1,212,000	3,304,272	2,854,028	585,000	555,000	1,120,000	1,106,000	1,212,000	1,030,000
April...	6,004,794	5,389,573	+11.4	4,939,794	4,349,573	1,235,000	1,152,000	3,154,794	2,655,573	550,000	542,000	1,065,000	1,040,000	1,191,000	1,009,000
May...	6,152,097	5,436,704	+13.1	5,062,097	4,386,704	1,252,000	1,164,000	3,268,097	2,677,704	542,000	535,000	1,090,000	1,050,000	1,270,000	1,075,000

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

TABLE III—CENTRAL-STATION FINANCIAL OPERATIONS FOR FOUR MONTHS IN THE UNITED STATES
(100 Per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated Distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1927 Thousands	1926 Thousands	Per Cent Inc.	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands
February.	$152,300	$138,500	+10.2	$94,100	$86,200	$42,100	$38,300	$5,400	$4,800	$10,700	$9,200	$61,300	$55,730
March....	146,200	133,600	+ 9.4	88,100	82,500	41,900	36,900	5,300	4,750	10,900	9,450	63,000	57,900
April.....	145,700	132,500	+10.0	86,700	80,600	43,400	37,400	5,100	4,830	10,500	9,670	62,260	57,060
May.....	140,900	126,500	+11.4	83,500	77,600	42,000	35,200	4,900	4,600	10,500	9,100	62,570	57,200

†Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡Do not include interest, taxes, depreciation or sinking fund.

national average in gains over the previous year.

Revenue figures lead to similar conclusions; New England companies reporting show an increase of about 10 per cent in earnings; those in the Atlantic States, 12; North Central, 9 per cent, with more activity in the eastern than in the western section; South Central, 20, and the Far West 11 per cent.

Indications are that the sale of energy to other companies for resale, which was growing by leaps and bounds a year ago, is not now increasing so rapidly; whereas jumps of 30 per cent were for a time common, a year's interval now brings a change that is nearer to 20 per cent. It is not clear whether this means that the most important interchanges of energy have been established, and that the additions are gradually becoming less significant, or that the consolidations which have been going on apace in recent years have converted into intracompany business, within the larger systems, an energy flow that formerly appeared as intercompany sales. Possibly both factors are present.

Hydro energy still constitutes a remarkably large part of the total, 42 per cent, and the May output exceeded that of March; further the percentage increase over last year, though smaller than in January or February, was nevertheless greater than that from fuel. Water power is growing relatively a little faster than the total output. Fuel consumption is increasing less rapidly than fuel-produced energy, because of the constant increase in plant efficiency; 12.4 per cent more energy was generated for 6.5 per cent more coal than last year, 14.7 per cent less oil and 26.2 per cent more of natural gas. Less fuel oil was used than in any month since the Geological Survey began collecting data on the subject, although the most rapid expansion in the electric power industry is that occurring in oil-producing regions.

Electric Investors Builds Up Larger Earnings and Surplus

THE possibilities of the investment trust idea as applied to the public utility industry are well illustrated in Electric Investors, Inc., whose annual report has just been issued. Diversification, the central feature of the investment trust principle is extended geographically into 47 states as well as nine other countries and in addition into several other branches of industry.

The investment trust usually draws its profits from two sources—current return and appreciation in principal value of its holdings. From both of these Electric Investors profited substantially, adding also a third source—commissions received in connection with financial transactions. Net earnings of $2.34 a share for the year ending Dec. 31 last on the 788,953 shares of common stock outstanding represents a quite attractive yield, but the yield is much increased in the report for the year ending May 31 when earnings were $3.21 a share.

The list of securities held by Electric Investors is in a rather remarkable way adapted to the purpose. The utility holding company securities may be said to involve diversification to an unusual degree within themselves. But there is also a further diversified list of industrial and other securities, added, it might be assumed, to mitigate

TABLE IV—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL PLANTS IN THE UNITED STATES*
(100 Per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro-Plants			Fuel Power Plants			Coal			Oil			Gas		
	1927 Thousands of Kw.-Hr.	1926 Thousands of Kw.-Hr.	Per Cent Increase	1927 Thousands of Kw.-Hr.	1926 Thousands of Kw.-Hr.	Per Cent Increase	1927 Short Tons	1926 Short Tons	Per Cent Increase	1927 Barrels	1926 Barrels	Per Cent Increase	1927 Thousands of Cubic Feet	1926 Thousands of Cubic Feet	Per Cent Increase
February..	2,172,740	1,886,471	+15.2	3,533,728	3,304,174	+ 6.9	2,958,797	2,886,534	+2.5	646,558	683,580	— 5.4	3,859,791	3,328,365	+15.9
March.....	2,551,792	2,237,457	+14.1	3,762,480	3,489,571	+ 7.8	3,090,984	3,071,092	+0.6	612,657	670,248	— 8.6	4,312,322	3,899,085	+10.6
April.....	2,490,836	2,279,976	+ 9.3	3,513,958	3,109,597	+13.0	2,936,441	2,742,058	+7.1	541,315	600,368	— 9.8	4,398,510	3,465,746	+26.9
May.....	2,586,692	2,266,305	+14.1	3,565,405	3,170,401	+12.4	2,898,920	2,720,082	+6.5	484,955	569,125	—14.7	4,732,216	3,712,226	+26.2

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

the possibility of any adverse influence upon the public utility industry as a whole. Taking the complete list, it would be a major disaster indeed that would be of sufficient weight to impair the earnings seriously of this widely diversified group. As pointed out by the president in addressing the shareholders, instead of analyzing 82 companies in respect to taxes and other pertinent matters, the shareholder is dealing only with one company and one which possesses a statistical department admirably equipped to assume the burden of such analysis.

The largest public utility investments of the company are in 31 utilities the position of each of which is well established. The aggregate market value of the securities of these companies at a recent date represented 85 per cent of the total market value of all securities owned. Electric Investors, Inc., is thus primarily a public utility investment company. Gross earnings of these companies for the past year exceeded one billion dollars, and their service extends to more than 50,000,000 people.

The other 15 per cent of investment holdings is in a well-diversified group of industrial, financial and merchandising companies. The company's surplus at the end of May was $4,256,681 against $2,244,466 at the end of the month of December last year.

Half-Year Public Utility Listings

The following electric light and power issues were listed on the New York Stock Exchange during the first six months of 1927. Bond issues totaled $81,098,500 and stock issues exceeded $403,000,000.

Name of Issue	Due	Rate	Amount
North American Edison, debentures	1957	5	$25,000,000
Public Serv. Elec. & Gas, ref.	1965	5	22,348,000
Montana Power, ref.	1943	5	1,500,000
American Water Works & Elec., deb.	1957	6	8,000,000
New Orleans Public Service, ref. B	1955	5	8,000,000
Utah Power & Light, 1st	1944	5	7,500,000
Niagara, Lockport & Ontario Power, ref.	1955	5	3,750,000
Louisville Gas & Elec. ref.	1952	5	2,000,000
Kansas City Power & Light, 1st B	1957	4½	3,000,000
Total			$81,098,000

Among the public utility stocks listed were the following:

Name of Issue	Rate	Amount
Cons. Gas of N. Y. 1,200,000 sh.	$5	$109,200,000
Cons. Gas of N.Y., com. 720,000 sh.		54,000,000
Commonwealth Power, com. 1,365,476 sh.		69,639,225
Public Service of New Jersey, com. 1,327,855 sh.		45,147,070
Public Service of N. J., pf.	6	11,982,000
Public Service Elec. & Gas, pf.	6	42,060,300
Columbia Gas & Electric, com. 375,000 sh.		22,500,000
Brooklyn Edison capital		15,000,000
Virginia Electric & Power, pf.	7	10,487,000
Virginia Electric & Power, com.		2,779,600
North Am. Co., com. 107,188 sh.		6,404,940
Pacific Gas & Electric, com.		5,287,000
Southern California Edison, cap.		4,268,300
Am. Pwr. & Light, com. 35,934 sh.		2,227,910
Utilities Power & Light, Class A, 66,444 sh.		1,661,100
Philadelphia Company, com.		387,000
Amer. Water Wks. & Elec., com.		323,960
General Gas & Elec., Class A, 9,821 sh.		245,525
Federal Light & Traction		124,640
Total		$403,725,570

Central Power Bonds. — The Central Power Company of Grand Island, Neb., has been authorized to issue $3,770,000 of series D 30-year gold bonds, bearing 5 per cent interest, to be sold at not less than $92, and $300,000 worth of 7 per cent preferred stock and $665,100 common stock, at par, to retire outstanding 6 per cent bonds of a total

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday July 26	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	99½	83	101½
Adirondack Pwr. & Lt.—7% pf.	111½	107	111½
Adirondack Pwr. & Lt.—8% pf.	114	112	115
Ala. Pwr., $7 cum. pf.—no par	110½	107	112½
Allis-Chalmers Mfg., 7% pf.	m111½	109	112½
Allis-Chalmers Mfg., 6% com.	108½	88	111½
Aluminum Co. of Amer., com.	87	67½	105
Aluminum Co. of Amer., 6% of	102	101½	104½
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	100½	86½	102
Amer. & Foreign Pwr., com.—no par	21½	18½	25½
Amer. Bosch Magneto, com.—no par	19	13	22½
Amer. Brown Boveri Elect.	11	10½	39½
Amer. Brown Boveri Elec., pf. $7	k 58½	50½	98
Amer. Gas & Elec., 6% pf.—no par	k101	....	....
Amer. Gas & Elec., com.†—no par	91	68½	100½
Amer. Lt. & Trac., 6% pf.	115	112	120
Amer. Lt. & Trac., new com.	172½	167	178½
Amer. Pwr. & Lt., 6% pf.	102½	97½	106½
Amer. Pwr. & Lt., com.†—no par	61½	54	67
Amer. Pub. Serv., 7% pf.	a 98	94	104
Amer. Pub. Serv., com.†	65	....	....
Amer. Pub. Utilities, 7% pfc. pf	85	73	88
Amer. Pub. Utilities, 7% pr. pf.	a 93	93	96
Amer. Pub. Utilities, com.	56	65	70
Amer. States Sec., A	3	2½	4½
Amer. States Sec., B	3	2½	4½
Amer. Superpwr., 6% pfc. pf.—25	29½	26½	29½
Amer. Superpwr., 6% 1st pf.	f 98	....	....
Amer. Superpwr., Class A†—no par	m36½	27½	38½
Amer. Superpwr., Class B†—no par	36½	28½	39½
Amer. Wtr. Wks. & Elec., 7% pf.	111½	105	111½
Amer. W. W. & E., com. $1.60—20	94	62½	98
Anaconda Copper cap. $3	k 45½	41½	49½
AppalachianElectric Pwr., 7% pf.	102	100	105
AppalachianElec. Pwr., 7% 2nd pf.	101	200	102
Appalachian Elec. Pwr., com.	m78	....	....
Arizona Pwr., 7% pf.	78	77	84½
Arizona Pwr., com.	20	....	....
Arkansas Pwr., & Lt. 7% pf.	103	....	....
Assoc. Gas & Elec., $3.50—50	51	....	....
Assoc. Gas & Elec., pf.—$6—no par	92	85	93
Assoc. G. & E., Class A, 10—no par	40½	35	43
BABCOCK & WILCOX, 7% com.	114	113	115
Binghamton L., H. & P., $6 pf.	98	93	98
Birmingham Elec., pf.—$7—no par	107½	105	109
Blackstone Valley G. & E., 6% pf.	106	103	105
Blackstone Valley Gas & Elec., 10% com.—50	135½	98	154½
Blaw-Knox, com.†	t 73	70	73
Brazilian Trac., Lt. & pwr., com.†	f168½	97	103
Broad River Pwr., 7% pf.	101	97	103
Brooklyn Edison, 8% com.	171	148½	176½
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	f 25½	....	....
Buffalo, Niagara & East. Pwr. com. $1—no par	f 32	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	97	96	99½
California Ry. & Pwr., 7% pf.	135	125	150
Carolina Pwr. & Lt., pf.—$7—no par	f108½	107	108½
Central & S.W. Util., $7 pf.—no par	a 97	93½	97½
Central & S.W. Util., pr.ln.$7 pf.—no par	a102	101	102
Central Ariz. Lt. & Pwr., 8% pf.	k 97	95	98
Central Ark. Ry. & Lt., 7% pf.	102	100	104
Central Ill. Pub. Serv., $6 pf.	a 91½	88½	95½
Central Ind. Pwr., 7% pf.	92½	86	95
Central Pwr. & Lt., 7% pf.	101	100½	103
Central States Elec., 7% pf.	95	93	96
Central States Elec., com.†	m200	....	....
Century Elec., 6% com.	m115	115	115
Chicago Fuse Mfg., com.—$2.50 no par	a 35	30	35
Cincinnati Gas & Elec., 5% com.	g 94½	96½	99
Cities Service, 6% pf.	f 87½	....	....
Cities Service, pf. B—10	f 8	....	....
Cities Service, pf. BB—100	f 82	....	....
Cities Service, com.—20	f 45½	....	....
Cities Service, Bks. Shrs.—10	f 22½	....	....
Clarion River Pwr., 8% pf.	95	....	....
Cleveland Elec. Illg., 6% pf.	110½	108	110
Cleveland Elec. Illg., 10% com.	320	285	310
Columbia Gas & Elec., 6% pf.	106	99½	107½
Columbia G. & E. com. $5—no par	93½	82½	98½
Columbia Ry., Gas & Elec., 6% pf.	m106	....	....
Columbus Elec. & Pwr., $2 com.—no par	64	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf.	102½	98½	102½
Columbus Ry., Pwr. & Lt., 6½% pf. B	101	96	103½
Columbus Ry., P. & L., com.—no par	100	75	105
Commonwealth Edison, 8% com.	a151½	138	155
Commonwealth Pwr., 6% pf.	99½	91½	100
Commonw'th Pwr., $2, com.—no par	53½	48½	54½
Conn. Lt. & Pwr., 8% pf.	k120	119	123
Conn. Lt. & Pwr., 7% pf.	117	112	115½
Cons. Gas of N. Y., pf.	98	93	98½
Cons. Gas of N. Y., com $5—no par	106	94	109½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	e112½	106½	112½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	e112½	110½	112½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	e115½	112½	115½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	e128½	127	129½
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $2.50—no par	e 58½	51	59½
Consolidated Pwr. & Lt., 7% pf.	105	100	106
Consumers Pwr., 6% pf.	101½	100	102
Consumers Pwr., 6.6% pf.	104½	103	105½
Continental Gas & Elec., 8% pfc. pf.	106	103	106½
Continental Gas & Elec., 7% pr. pf.	102	100	103
Conti. G. & E. com. $4.40—no par	k210	210	225
Crocker Wheeler, com.†	27	30	38
Crocker Wheeler, 7% pf.	84	78	88
DALLAS PWR. & LT., 7% pf.	108½	107	109½
Dayton Pwr. & Lt., 6% pf.	k106	101	103
Detroit Edison, 8% com.	149	133½	157
Dubilier Condenser, com.—no par	4	3½	5½
Duquesne Lt., 7% pf.	116	114½	116½
EASTERN NEW YORK UTIL., $7 pf.	105	102	104½
Eastern New York Util. com.	65	70	75
Eastern States Pwr., $7, com.	8	9	13
Eastern States Pwr., pf.	90	90	95
East. Tex. Elec., 7% pf.	k106	106	108
Edison Elec. of Boston, $12 com.	d241½	241½	242
El Paso Elec., 7% pf.	107	105	107½
Elec. Bond & Share, 6% pf.	f107½	105½	109
Elec. Bd. & Sh. Sec., com. $1—no par	f 74½	67½	79½
Electric Household Util.†	a 12½	11	15½
Elec. Investors, 6% pf.—no par	94	92	96
Elec. Investors, com.†—no par	37	32½	40½
Elec. Investors, 10% pd. receipts	m 15	....	....
Elec. Pwr. & Lt., ctfs. pf.	103½	96	106½
Elec. Pwr. & Lt., ctfs., 40% pd.	k114½	103½	115
Elec. Pwr. & Lt., ctfs, full pd.	m114	108½	111½
Elec. Pwr. & Lt., ctfs., com.—no par	22½	16½	23½
Elec. Refrig. cap.†	15½	12½	37½
Elec. Ry. Securities, com.—no par	7½	....	....
Elec. St. Battery com. $5.25—no par	k 68½	63½	79½
Elmira Wtr., Lt. & R.R., 7% pf.	102	99	101½
Emerson Elec., pf.	m109	107½	111
Empire Pwr., ptc.†	35	....	....
Engr. Pub. Serv., $7 pf.—no par	k103½	93½	106½
Engr. Pub. Serv., com.—no par	27½	21½	28½
Eureka Vacuum Cleaner, com. $4—no par	68½	60½	74½
FAIRBANKS MORSE, 7% pf.	k110	107½	112
F.-M., com.—$3—no par	38½	37½	43½
Federal Lt. & Trac., com. $1.40	41½	37½	47
Federal Lt. & Trac., $6 pf.—no par	98	91½	99½
Ft. Worth Pwr. & Lt., 7% pf.	k110½	108	112
GALVESTON-HOUSTON ELEC. 6% pf.	73	68	72
Galveston-Houston Elec., com.	24	28	32
Gen. Elec., $3 com.—no par	124	81	124½
Gen. Elec., special—6%	11½	11	11½
Gen. Gas & Elec. (Del.) com. A. $1.50—no par	39½	34	47½
Gen. G. & E. (Del.) com. B—no par	m 43½	35½	43½
Gen. G. & E. (Del.) pf. A. $8—no par	k115½	113½	120
Gen. G. & E. (Del.) pf. A $7—no par	k108	100	109½
Gen. G. & E. (Del.) pf. B $7	k102	96	105
Gen. Pub. Serv., $7 cum. pf., no par	k107	102	106
Gen. Pub. Serv., com., no par	13½	11½	15½
Ga. Lt., Pwr. & Rys., 6% pf.	92	87	96
Ga. Lt., Pwr., & Rys., com.	m 45	....	....
Ga. Ry. & Pwr., 8% pf.	k123	119	125
Ga. Ry. & Pwr., 7% pf.	k113	106	110
Gt. Western Pwr., 7% pf.	h102	....	....
IDAHO PWR., 7% pf.	107½	103	109
Ill. No. Utilities, 6% pf.	a 95	92	97
Ill. Pwr. & Lt., 7% pf.	99½	99	101
Ingersoll Rand com. $8	k 88	88½	96½
Int. Combus. Engr., com. $2—no par	k 46	43½	64
Int. Util., Class A—$3.50—no par ex.div	38½	28	41½
Int. Utilities, Class B—no par	5½	3	7½
Interstate Pwr., pf.—$7—no par	94½	93	98
Interstate Pub. Serv., 7% pf.	99	98	99½
Iowa Ry. & Lt., 7% pf.	97½	97	99
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	101	97½	103
Johns-Manville, com. † —no par	82½	55½	86

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, July 23. lBid price Wednesday, July 27. mLatest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday July 26	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	*k*115	112	115½
Kansas Gas & Elec., 7% pf.	*l*106½	103	107
Kentucky Hydro-Elec., 7% pf.	*k* 95½	98	98
Kentucky Sec.,6% pf.	*k* 86	83	87
Kentucky Sec., 5% com.	109	110	115
Kentucky Utilities, 6% pf.	100	95	98½
Keystone Pwr. & Lt., 7% pf.	102	96½	100½
LACLEDE GAS LT., 12% com.	*k*240	173½	267½
Lehigh Pwr. Sec., com.—no par.	18½	15	20
Long Island Ltg., 7% pf.	109	107	112
Long Island Ltg., com.†—no par.	135	139	153
Los Angeles Gas & Elec., 6% pf.	*k*102½	98	104
Louisville Gas & Elec., cl. A. $1.75	*k* 26½	23½	28
MAN. ELEC. SUPPLY, cap. $5 —no par	106	53½	108
Manila Elec., com.†—no par.	42½	40	46
Maytag Mfg., com. .50—no par.	30	23½	32½
Memphis P. & L., pf.—$7—no par	108	107	109
Metropolitan Ed., pf.—$6—no par.	99	93	100
Metropolitan Ed., pf.—$7—no par.	107	104	108
Metropolitan Ed., com. $5—no par.	67	....	....
Middle West Utilities, 7% pf.	*a*110½	105½	113½
Middle West Util., 8% pr. lien	*a*120½	117½	122½
Middle West Util., com. $6—no par	*a*111	108	117½
Midland Utilities, pr. ln. 7% pf.	*a*104½	92½	104½
Midland Utilities, 7% pf. A.	*a*100½	96	109½
Milwaukee Elec. Ry. & Lt., 7% pf.	*k*102	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	*k* 98½	98	101½
Minn. Pwr. & Lt., 7% pf.	*l*105½	104	107
Miss. Pwr. & Lt., $8 pf.	101	106	103
Miss. River Pwr., 6% pf.	101	94	103
Miss. River Pwr. 3% com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7 —no par.	102	100	109
Mohawk Hudson Pwr., 2d pf.—$7 —no par.	110	98	109
Mohawk Hudson Pwr., com.—no par	24½	20½	27
Montana Pwr., 7% pf.	*k*106½	118½	106½
Montana Pwr., 5% com.	104	81½	106½
Montreal Pwr., 7½% com.	*f* 83½	....	....
Mountain States Pwr., 7% pf.	100	97	101
Mountain States pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	107	98	105
National Carbon, 8% pf.	*a*137½	130½	137½
National Elec. Pwr., A†	*a* 24½	23½	25½
National Lt., Ht. & Pwr., com.	24	....	....
National, Light, Ht. & Pwr., 5% pf.	70	....	....
National Pwr. & Lt., pf.—$7—no par	106½	101	108½
National Pwr. & Lt., com.†—no par.	21½	19½	23½
National Pub. Serv., 7% pf.	97½	93	100
National Pub. Serv., 7% ptc., pf.	113	108	115
National Pub. Serv., A com. $1.60— no par.	21½	18½	24
National Pub. Serv., B com.—no par	18½	14	20½
Nebraska Pwr., 7% pf.	*l*108½	106	108½
Nevada-Calif. Elec., com.	*m* 26½	25	31
New Brunswick Pwr., 4% pf.	55	....	....
New Eng. Pub. Serv., pr. ln. pf. $7..	100	98½	101
New Eng. Pub. Serv., pf. $7..	96	95	97½
New Orleans Pub. Serv.—7% pf.	103	103	105½
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	92	91	95
N. Y. Central Elec., 7% pf.	101	102	104
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	....	....
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	....	....
Niagara Falls Pwr., 7% pf.—25..	28½	27½	29½
Niagara, Lock. & Ont. Pwr., 7% pf.	111	110½	113
No. Amer., 6% pf.—50.	52½	50	52½
No. Amer., com.—10	48½	45½	52½
No. Amer. Edison, $6 pf.—no par....	101½	96½	101½
No. Caro. Pub. Serv., pf.—$7—no par	101	93	102½
Northeastern Pwr., com.	19	14½	20½
No. Indiana Public Service, 7% pf. A.	103	102	104
No. N. Y. Utilities, 7% pf.	106	103	109
No. Ohio Pwr., com.—no par.	12	9½	13½
No. Ohio Trac. & Lt., 6% pf.	83½	78	81
No. Ohio Trac. & Lt., 7% pf.	*l* 93½	90	93
No. Ont. Lt. & Pwr., 6% pf.	12½	84	95
No. Ont. Lt. & Pwr., 4% com.	72	73	78
No. States Pwr., (Del.) 7% pf.	105	101	107½
No. States Pwr., (Del.) 5% com.	116½	....	....
No. Texas Elec., 6% pf.	66	65	70
No. Texas Elec., com.	23	27	36
OHIO BRASS, com. B $4—no par.	82	74	85
Ohio Brass, 6% pf.	105	100	105
Ohio Pwr., 6% pf.	102	96	103
Ohio Pub. Serv., $6 pf.	98	95	96½
Ohio Pub. Serv., 7% pf.	106½	103	109
Ohio River Edison, 7% pf.	107½	....	....
Oklahoma Gas & Elec., 7% pf.	100	....	....
PACIFIC GAS & ELEC., 6% pf.	26½	24½	26½
Pacific Gas & Elec., 8% new com.	38	....	....
Pacific Pwr. & Lt., 7% pf.	*l*104	102	104
Penn Cent. Lt. & Pwr., $5 pf.—no par	*c* 75	71½	76½
Penn-Ohio Edison, 7% pf.	101	97½	104
Penn-Ohio Elec., 7% pf.	99	98	100
Penn-Ohio Pwr. & Lt., 7% pf.	106½	99	103
Penn Pwr. & Lt.—$7—no par.	*l*108½	107	108½
Penn Wtr. & Pwr., 8% com., new	*c* 54	47½	54½
Phila. Co., 6% pf.—50.	*c* 52	49½	52½
Phila. Co., com.—50.	104½	85½	110
Phila. Elec., 8% com.—25.	*c* 50½	46½	54
Portland Elec. Pwr., 7% pf.	98½	97½	101
Portland Elec. Pwr., 6% pf.	79	78	83
Portland Elec. Pwr., 6% 2d pf.	55	55	70
Portland Elec. Pwr., com.	26	22	30
Potomac Elec. Pwr., 6% pf.	*l*108½	....	....
Pwr. Corp. of N. Y., com. $1—no par	*m* 79	....	....
Pwr. Sec., pf.—no par.	*k* 28	28	33
Pwr. See., com.—no par.	*k* 6	5	8
Public Serv. of Colorado, 7% pf.	*l*102	....	....
Pub. Serv. of N. J., 6% pf.	100½	98½	101½
Pub. Serv. of N. J., 8% pf.	*k*130	125	132
P. S. of N. J., $2 com.—no par.	40½	32	45½
Pub. Serv. of No. Ill., 6% pf.	*a*103½	101½	105½
Pub. Serv. of No. Ill., 7% pf.	*m*117	112½	117
P. S. of No. Ill., com. $8—no par.	*a*139½	130½	143
Pub. Serv. of No. Ill., $8 com.	*m*141	132	142
Pub. Serv. of Okla., 7% pr. ln.	100	99	100½
Pub. Serv. Elec. & Gas, 6% pf.	107½	102	108½
Puget Sound Pwr. & Lt., 7% pr. pf.	108	105	107
Puget Sound Pwr. & Lt., $6 pf.—no par.	79	....	....
Puget Sound Pwr. & Lt., com.	33	28	35½
RADIO CORP. OF AMER., $3.50 pf.—50.	52	49	53
Radio Corp. of Amer., com.—no par.	61½	41½	62½
Republic Ry. & Lt., pf.	*k*120	....	....
Republic Ry. & Lt., com.	*k*135	112	135
Rochester Gas & Elec. 6% pf. D....	*k*104	101	103½
Rochester Gas & Elec., 7% pf. B ..	107	105	107
Rochester Gas & Elec., 6% pf. C...	104	101½	103½
SAFETY CABLE, com. $4.	71½	52½	74½
San Joaquin Lt. & Pwr., 7% pr. pf.	106	105	108
St. Joseph Ry., L., H. & P., 5% pf..	72	70	73
Servel Corp.	2	1	10½
Sierra Pacific Elec., 2% com.	26	26	28½
Sioux City Gas & Elec., 7% pf.	101½	99	104
Southeastern Pwr. & Lt., pf.—$7 —no par	*l*104½	....	....
Southeastern Pwr. & Lt., ptc. pf.	*l* 79½	....	....
Southeastern Pwr. & Lt., com.—no par	35½	29½	38½
So. Calif. Edison, 8% pf.	38	36½	38
So. Calif. Edison, 7% pf.	28½	27½	29
So. Calif. Edison, 6% pf.	25½	24½	25½
So. Calif. Edison, 8% com.	35½	31½	36½
Southern Cities Utilities, 7% pf.	77	67	86
Southern Cities Utilities, com. $4..	*m* 37	....	....
Southwestern Lt. & Pwr., A $3.	65	60½	65
Southwestern Lt. & Pwr., B.	65	60	65
Southwestern Lt. & Pwr., $6 pf.	84	83	91½
Southwestern Pwr. & Lt., 7% pf.	108	103	110½
Springfield (Mo.) Ry. & Lt., 7% pf.	102	95	102
Standard Gas & Elec., 8% pf.	63	57½	64
Standard Gas & Elec., 7% pr. pf.	106	103	110
Standard G. & E., com. $3.50—no par.	61½	54	65½
Standard Pwr. & Lt., 7% pf.	100	98	102½
Staten Island Edison, pf.—$6—no par.	100½	99	101
Superheater, $6 com.—no par.	170	....	....
Syracuse Lighting, 7% pf.	105½	103	107
Syracuse Lighting, 8% pf.	115	118	115
Syracuse Lighting, 8% com.—no par	*m*300	....	....
TAMPA ELEC., com. $2.	58½	....	....
Tenn. Elec. Pwr., 6% pf.	96½	92	97
Tenn. Elec. Pwr., 7% pf.	107	103	106½
Terre Haute, Ind. & East. Trac., 5% pf.	26	20	30
Terre Haute, Ind. & East. Trac., com	1	1	3
Tex. Pwr. & Lt., 7% pf.	*l*108½	106	108½
Tide Water Pwr., 8% pf.	108	105	110
Timken Roller Bear., com.—$4 no par.	115½	78	116½
Toledo Edison, 8% pf.	115	115	118
Toledo Edison, 7% pf.	*l*106½	....	....
Toledo Edison, 6% pf.	98	95	97
Toledo Edison, 6% com.	98	....	....
Tri-City Ry. & Lt., 6% pf.	96	90	97
UNITED GAS & ELEC., 6% pf.	101	98	102
United Gas & Elec., com.—no par.	*m* 57	....	....
United Gas & Elec. (N. J.) 5% pf.	70	70	73
United Gas Impr., 8% com.—50.	*c*103½	89½	108½
United Lt. & Pwr., pf.—$4—no par.	50	49	53½
United Lt. & Pwr., pf.—$6.50—no par.	95½	87	97½
United L. & P., com. A .48—no par.	13½	12½	15½
United L. & P., com. B .48—no par.	*m* 18	15	18
Utah Pwr. & Lt., 7% pf.	*l* 107	104	108½
Utica Gas & Elec., 7% pf.	105	105	106½
Utica Gas & Elec., 8% com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	95½	93	100
Utilities Pwr. & Lt., com. A $2.	31	27	34
Utilities Pwr. & Lt., com. B $1—no par.	17½	13½	19
VERMONT HYDRO-ELEC., 7% pf.	98	95	99
Virginia Elec. & Pwr., 7% pf.	107	105	107
Virginian Pwr., 7% pf.	108	....	....
Virginian Pwr., com.	75	....	....
WAGNER ELEC., 7% pf.	*m* 88	68	90
Wagner Elec., com.—no par.	*b* 32	18½	39½
Washington Ry. & Elec., 5% com.	*j*258	....	....
Washington Ry. & Elec., 5% pf.	*j* 92	....	....
Washington Wtr. Pwr., 8% com.	156	136	168
West Penn Elec., 7% pf.	*k*110½	102	111½
West Penn Elec., Cl. A $7.	*k*108	97½	110
West Penn Pwr., 7% pf.	*k*115	111	118
West Penn Pwr., 6% pf.	104½	100½	108½
West Virginia Lt., Ht. & Pwr., 7% pf.	90	94	96
West Va. Utilities, 7% pf.—50.	51½	48	51½
Western Pwr., 7% pf.	*k* 99	98	101½
Western States Gas & Elec., 7% pf.	100	96	100½
Western States Gas & Elec., com.	24	....	....
Westinghouse Elec. & Mfg., 8% com. —50.	86½	67½	88½
Weston Elec. Instrument, Cl. A $2 —no par.	*k* 31	30½	34½
Weston Elec. Instrument, com.—no par.	*k* 14	13½	18½
Wheeling Elec., 6% pf.	100	95	100
Worthington Pump, 7% pf. A.	54	46	61½
Worthington Pump, 6% B.	48½	40	54½
Worthington Pump, com.	37	20½	46
YALE & TOWNE com. $5—25.	*k* 81½	70	82

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f* Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, July 23. *l*Bid price Wednesday, July 27. *m*Latest quotations available. †Dividend rate variable.

value of $2,455,200; to purchase fixed property and current assets of the Water & Light Company of Nebraska City in the sum of $1,149,380 and to pay $324,090 for additions and betterments up to April 30, 1927, and $150,000 for construction now in progress.

Earnings Up 20 Per Cent.—Gross earnings of the Southern California Edison Company for the six months ended June 30, 1927, amounted to $14,689,592, as compared with $12,716,244 for the corresponding period of 1926, an increase of $1,973,348.69, or 16 per cent. The net earnings after operating expenses and taxes amounted to $10,024,636, as against $8,350,855.75 last year, an increase of $1,673,780.26, or 20 per cent.

Austrian Company Reports Increased Revenue.—An increase of 10 per cent in gross revenues for the year ended April 30, 1927, was reported by the Lower Austrian Hydro-Electric Company. Net earnings for the year show an increase of nearly 20 per cent over those of the preceding year.

Recent Listings. — The New York Stock Exchange has authorized the listing of certificates of deposit issued by the Bankers Trust Company, as depositary, for common stock of the American Water Works & Electric Company of Virginia, amounting to $13,490,980, on official notice of issuance in exchange for outstanding common stock certificates. There has also been authorized the listing of $930,500 first lien stamped 5 per cent sinking fund gold bonds of the Federal Light & Traction Company. The exchange has authorized the listing of additional common stock of the Pacific Gas & Electric Company, totaling $6,500,000, making the total amount of common stock applied for $64,732,800, and of 60,750 additional shares of Class A stock of the Utilities Power & Light Corporation on official notice of issuance and payment in full, making the total amount applied for 434,947 shares of Class A stock.

William H. Despard of Toronto, has been elected to the board of directors of the International Utilities Corporation. Mr. Despard recently retired as vice-president and general manager of White & Company, Ltd., of Toronto and Hamilton, Ontario, and is at present president of the Dominion Feldspar Corporation.

Japanese Power Company Increases Capital. — The Great Consolidated Power Company of Japan (Daido) has increased its capital stock from 2,259,260 shares of 50-yen par value, fully paid, to 3,460,000 shares, according to advices received by Dillon, Read & Company, the company's bankers in this country.

Manufacturing and Markets

Copper Stocks Decline

Production Below Consumption—Curtailment Still Expected—Potential Overproduction a Factor

WORLD copper consumption in the first half of 1927 was slightly greater than production. The increase in production in the first half of 1927 was about 3¾ per cent and the absorption of the increased production as evidenced by a diminution of stocks, according to the report of the American Bureau of Metal Statistics, indicates that world consumption not only increased but was even more than the increase in consumption in 1926 over 1925, which was reckoned at about 3 per cent.

The production of refined copper in North and South America in the first six months of 1927 was 747,368 tons. The world's production of refined copper for this period is as yet unknown, but in 1925 the refiners in North and South America accounted for 84.7 per cent of the total and in 1926 for 85 per cent, and in all probability their ratio in the first half of 1927 was of about the same order. The average production by American refiners, North and South, in the first half of 1927 was 124,561 tons per month compared with about 120,000 tons in the twelve months of 1926. The average of world's production in 1926 was 141,262, and in all probability that average for the first six months of 1927 was about 146,500.

The total stock of copper in and at smelteries and refineries in North and South America and in transit between them, including what was in the process of refining, was 358,636 tons at the beginning of January, 1927, and 353,983 tons at the end of June, a decrease of 4,653 tons, as shown in the accompanying table. At the same time the stocks in Great Britain were 38,792 and 24,676 tons, a decrease of 14,116 tons, some of the British accumulation of crude copper having been brought to the United States for refining.

Although the June statistics fail to reveal any consequential decline in the rate of world production, the leading producers seem confident that curtailment still will prove to be more than a gesture. The price reached 12¾ cents three times this year but has never broken through. It looks as if that level was the bottom figure. Potential overproduction, that is, the idle available manufacturing capacity, is perhaps a most important factor in affecting prices. It is not believed that the price of copper will go much higher nor is there anything bullish in the situation.

WORLD'S VISIBLE SUPPLY OF COPPER IN PRODUCERS' HANDS

North and South America	In Tons 1924 Jan. 1	1925 Jan. 1	1926 Jan. 1	1927 Jan. 1	1927 July 1
Blister at smelters	17,836	9,306	10,461	15,849	15,103
Blister in transit	58,500	70,966	61,141	68,604	60,946
Blister at refineries	41,279	26,640	30,851	30,514	26,910
In process at refineries	135,765	130,616	146,422	158,168	154,673
Refined	155,885	136,434	73,082	85,501	96,360
Total	409,265	373,962	321,957	358,636	353,983
Foreign					
Great Britain	34,734	43,029	62,773	38,792	24,676
Havre	2,091	8,042	3,375	9,688	(a) 6,000
Japan	4,767	11,042	5,543	5,099	(a) 5,000
Grand total	450,857	436,075	393,648	415,215	389,650

(a) Estimated.

Chicago Plans for Refixturing

Utilities, Dealers and Manufacturers to Join in Relighting Activity Sept. 12-Dec. 30—Special Fixtures Recommended —$30,000 Fund to Carry on Work

COMPREHENSIVE plans to do a real job of refixturing have been completed by the electrical industry in the greater Chicago area and organization work is being pushed under the direction of Oliver R. Hogue, chairman of the general refixturing committee of the Chicago Electric Association. An intensive selling campaign by dealers and the electric utilities will be launched on Sept. 12 and continue until Dec. 1, during which time the sales organizations of Chicago's electrical fraternity will be concentrated upon refixturing the home.

Back of this activity there has been a vast amount of preparation necessary requiring the support and organization of the electrical jobbers, dealers, utilities, fixture and lamp manufacturers. In order to handle this work committees have been formed and weekly meetings are being held at which definite plans have been formulated and preliminary work carried on. These committees with their chairman are as follows: General committee, O. R. Hogue, Commonwealth Edison Company; program committee, A. M. Brown, Westinghouse Lamp Company; publicity committee, F. W. Harvey, McJunkin Advertising Company; technical committee, W. H. Rademacher, Edison Lamp Works of General Electric Company; committee to co-operate with manufacturers, dealers and jobbers, J. W. Collins, Electrical Contractors' Association; finance committee, Fred Farmer, Beardslee Chandelier & Manufacturing Company.

The schedule of the refixturing activity as developed calls for an extensive advertising campaign in seven newspapers, together with suitable posters, circulars and campaign literature to be distributed by the participating dealers. Approximately $20,000 will be expended on publicity of all kinds. It is estimated that a total fund of $30,000 will be required to carry through the activity which is being supported by the Commonwealth Edison Company, the Public Service Company of Northern Illinois and by subscriptions from those directly benefiting from the campaign. A large part of this fund has already been pledged.

Special Fixtures Recommended

As the refixturing campaign is predicated upon supplying better lighting in the home special fixtures will be sold by all dealers. The technical sub-committee will examine and pass upon fixtures to be offered and give each fixture a rating. A tentative design of the general type of fixtures and a method of rating have been prepared by the technical committee which closely parallels the method proposed by the Association of Edison Illuminating Companies and the Illuminating Engineering Society known as the "Franklin Method of Appraising Residential Luminaries."

The following basis has been adopted for rating purposes:

	Points
1. Illuminating Qualities:	
Freedom from glare	40
Illuminating power	35
Light distribution	20
Twilight switch feature	5
2. Structural Features:	
Mechanical construction	55
Electrical construction	40
Convenience receptacle	5
3. Appearance	100

It is proposed to have manufacturers submit samples of fixtures to this committee for test as outlined. Those fixtures passing the test will be awarded the official approval tag. Through newspaper and other forms of advertising the public will be urged to buy approved fixtures.

Recommendations for the adoption of the special type of fixture are based upon conclusions drawn from a survey of dealers by the technical committee which stated in its report: "The preponderance of unshaded fixtures being

exhibited in dealers' showrooms, and the general impossibility of adopting or applying satisfactory shades to these fixtures leads this committee to recommend that manufacturers develop a new line of fixtures incorporating the ideas of adequate shading, convenience outlet and twilight switch. The general willingness of about ten dealers, picked at random and doing an annual fixture business in excess of $10,000 each, to feature a fixture of this kind during the campaign leads this committee to believe this program would be commercially successful."

Beginning September 12, an intensive selling campaign will be started by dealers and the utilities. This campaign is to be assisted by newspaper advertising, handbills, or stuffers sent out either by dealers or by the utility to help the dealers' sales, by fixture style shows held at five or six locations in the city of Chicago, and to include one style show at the Edgewater Beach Hotel following the Illuminating Engineering Society convention October 10 to 14.

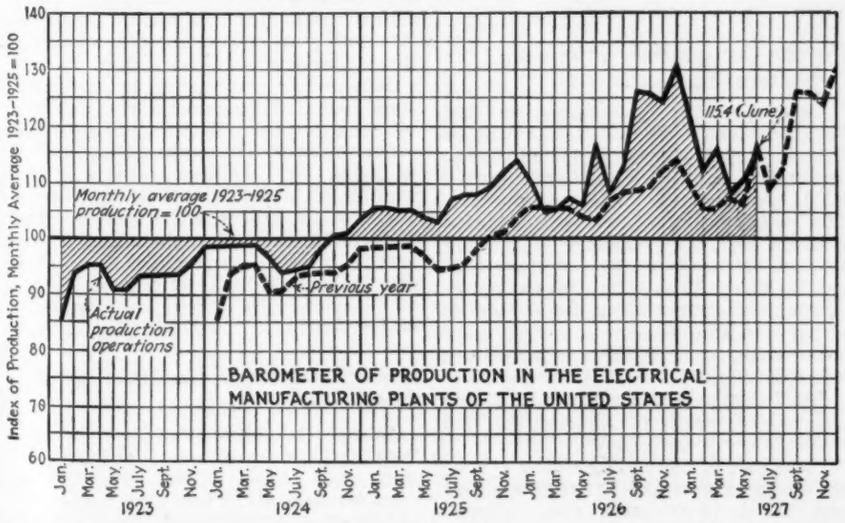
It is planned also to lease two moderately priced apartments, one of which will be equipped to show obsolete forms of fixtures and the usual conglomeration of drop cords, appliance cords, etc., and across the hall an identical apartment refixtured and decorated with light in the most approved manner. These apartments are to be moderately priced and equipped within the means of people in moderate circumstances. There are more than one million residential meters in the greater Chicago area and the general refixturing committee estimates that 450,000 of these homes are prospects for refixturing.

June Production Under Last Year

Electrical Manufacturing Plants Report June Production 0.8 per Cent Under June, 1926—June Activity 2.4 per Cent over May

DURING June, for the first time since March of last year, the electrical manufacturing plants of the nation reported that productive operations were under those of the same period of the year previous. June production in these plants was 0.8 per cent under June of last year. Not much of a decrease in production, it is true, but rather significant when it is remembered that the electric light and power branch of the electrical industry is reporting an annual growth in energy sales of about 10 per cent, and that the construction budget of these central-station companies during 1927 is $958,000,000, or 14 per cent over that of 1926.

Data Unadjusted for Seasonal Variation



The production reports of the first two months of the year indicated that the electrical manufacturing plants were going to set a production record far in excess of 1926, but the operations of the past three months would indicate that while the 1927 volume of production undoubtedly will exceed that of 1926, it will not be of as high an order as was to be expected. Following July, however, the operations will materially increase as the fall months unfold. There is every reason to expect that this increased production by the electrical manufacturing plants during the last half of the year will be comparable with, if not exceed, the remarkable increased operations reported during the same months of last year. Such is the status of operations in the electrical manufacturing plants of the nation, as indicated by the monthly consumption of electrical energy by a large proportion of these plants scattered throughout the nation.

While the June production appears to have been slightly under that of June last year, yet this production was about 4.4 per cent above that reported for the month of May. The June activity of these plants is found to have been 2.4 per cent over that of May, after corrections are made for the number of working days.

An upward trend in volume of production by the electrical manufacturing plants at this season of the year is to be expected, if past history is to be taken as a criterion. Such a general trend in production, however, has not been experienced by American industry as a whole, either in the comparative operations for May and June, or in the yearly comparison. Returns from 2,500 manufacturing plants consuming approximately 14,000,000,000 kw.-hr. of electrical energy per annum indicate that the June productive activity was 3.7 per cent under May, but was 8.4 per cent in excess of June of last year. June production of general industry was only 4.4 per cent under March production, which is a comparatively low rate of seasonal decrease when it is remembered that in 1926 this curtailment of production during the same period amounted to 13.3 per cent and that in 1925 it was 7.7 per cent. There seems to be every indication that general production during the present summer is holding up better than during any similar period since the war.

Illinois Laws Regulate Electrical Installations

New laws in Illinois regarding the regulation of the installation, alteration and use of electrical equipment require the registration of electrical contractors with an annual registration fee of $25. This includes any person, firm or corporation engaged in the business of installing or altering by contract electrical equipment for the utilization of electricity supplied for light, heat or power, not including radio apparatus, and not including apparatus conductors and other equipment installed for or by public utilities. Under the new law, effective July 1, 1927, any town may establish an electrical inspection department, and each municipality which establishes such an electrical inspection department shall also establish an electrical commission, consisting of five members. The law also defines the membership of this commission. The new laws have been published by the Electric Association, 30 North Dearborn Street, Chicago.

British Cable Makers Conclude Agreement

The leading cable manufacturers of Great Britain for some time have been negotiating with each other in an endeavor to find a way of co-operation which would be advantageous to all concerned in the industry. In regard to the machinery for producing cables, certain of the cable factories design and make a good deal of their own machinery, and it would be of advantage to the industry if its knowledge could be combined so that only the most efficient type of machine and methods of manufacture should be used. The protracted negotiations have finally culminated in an agreement between three of the largest manufacturers, namely, British Insulated Cables, Ltd., Callender's Cable & Construction Company and W. T. Henley's Telegraph Works Company. These firms will welcome

and have reason to expect that other cable makers will join in their cooperative movement. During the negotiations the fact has not been lost sight of that the interest of the consumer and the worker has to be protected as well as that of the manufacturer.

Business Conditions

WITH one month of the second half of the year already past the electrical industry does not report any particular change in business. The summer quietness is evidenced but underlying this is a current of activity presaged by the number of inquiries being received by manufacturers. Several large industrial equipment orders were reported, one amounting to $700,000. Good business is anticipated throughout the second half of this year and certainly no reasons now appear why this should not be the case.

In New England power apparatus is more active and good buying is noted in the industrial field. Wiring construction materials are in demand and appliance sales continue in good volume. An order for transformers, amounting to approximately 20,000 kva. was placed in the New York district by a holding company and several other orders are pending. Industrial buying has decreased somewhat. Power companies in the Southeast are busy extending their distribution systems and acquiring existing systems in small towns. Industrial buying is active and included an order for a 5,000-kw. turbo-generator, amounting to $80,000, $25,000 worth of motor equipment for a textile mill, and $20,000 worth of switching equipment for a steel mill. Activity continues in the oil fields in the St. Louis district. A 5,000-kw. turbo-generator unit was sold to a company in the southwestern part of the district. A fair volume of business is being transacted in the Middle West, and a somewhat more optimistic attitude is noticed. On the Pacific Coast many machinery orders were placed, the most outstanding being $130,000 worth of automatic rotary converter substation equipment. Quotations will soon be submitted for the first of four units for the Bear Creek power site on the Stanislaus River. The initial development will cost about $13,000,000.

Copper and Lead Prices Continue to Advance

Further advance in the price of both copper and lead was recorded in the domestic markets. The volume of business in copper has been neither unusually large nor small, although some sellers have declined orders at the prevailing prices. Lead was exceptionally active for several days, but has quieted somewhat. Zinc was reasonably brisk, with prices hardening a little in the middle of the week, but closing a trifle easier. Tin has been dull, and prices have shown little change.

NEW YORK METAL MARKET PRICES

	July 20, 1927 Cents per Pound	July 27, 1927 Cents per Pound
Copper electrolytic	12⅞	13
Lead, Am. S. & R. price	6.30	6⅛
Antimony	11⅝	12⅛
Nickel, ingot	35	35
Zinc spots	6.65	6.675
Tin, Straits	64	63⅛
Aluminum, 99 per cent.	26	26

Base copper price July 27, 1927, 14¼ cents.

Large Transformer Order Placed in New York District

Public utility buying is not very active in the New York district, but an improvement is reported in the volume of inquiries being received for quotations. An order for approximately 20,000 kva. in transformers was placed by a holding company for installation outside of New York, and several other orders are pending and are expected to be closed within the next ten days. The demand for switching equipment and circuit breakers is not very active, and sales of poles, crossarms, and line hardware are dull, although a good volume of inquiries for hardware was received. Industrial buying shows a falling off, control apparatus being very quiet. There is also a decrease in the demand for motors. Jobbers report a steady demand for conduit, fittings, and other wiring devices, but appliance sales are quiet.

Power Companies Extending Systems in Southeast

Central-station companies in the Southeast are buying in better volume than for several weeks past and though few individual large orders are reported total sales are reasonably satisfactory. The construction of new distribution systems and the purchase of existing systems in small towns and their connection to the lines of the larger power companies is stimulating the movement of motors and distribution and small power transformers, sales of which are reported satisfactory. One company ordered insulators amounting to $5,300 and $2,000 worth of distribution and small power transformers.

Purchases of meters, lightning arresters and disconnecting switches are also reported in reasonably good volume. Industrial buying is active and included an order for a 5,000-kw. turbo-generator for installation in a manufacturing plant in Louisiana and amounting to approximately $80,000. A textile mill in Alabama ordered motor equipment amounting to $25,000 while a steel mill in the same state placed an order for switching equipment, approximating $20,000.

Power Apparatus More Active in New England District

Sales of apparatus in the New England district indicate a better tone to the market, which is displaying increase activity in the industrial field accompanied by a fair volume of central-station trade. Purchases within the last few days include a 300-kw. electric oven for bread baking in a Boston establishment, an industrial fan motor order totaling about $14,000, a synchronous motor order amounting to about $15,000, and an outdoor substation material order of about $2,000 for northern New England. Three 2,500-kw. steam turbines have been sold by a Boston manufacturer's representative for Southern shipment.

Interior wiring work is more in evidence and a carload of iron conduit has been placed for a Boston office building extension, with more in prospect. Contractors are busier and as their stocks of wiring devices are low, jobbers are more active, one house reporting double the trade of a year ago. Poles and line material are in healthy demand. Appliance sales are showing life in the refrigerating equipment, electric range and washing machine fields, irons never cease to move in good volume, and household and office fans have sold well. Central-station supply sales are displaying better volume, but the demand for small motors has decreased. Inquiries are very active and cover diversified lines.

Fair Volume of Business Noted in Middle West

The volume of business in the Middle West is not large, but a substantial amount is being transacted. Apparently there has been a slight acceleration. Industrial activity continues spotty but a somewhat more optimistic attitude is being noticed. The various utility companies continue a conservative policy although greater construction activity is noticeable. Maintenance purchasing is increasing to some extent, one utility company's commitments averaging $65,000 per day and considerable purchasing of apparatus is going on. Jobbers report a fair volume of business. Most appliances are moving fairly well with a good demand for electric washers and refrigerators. Small motors are in good demand. Sales of ventilation equipment, created by active campaigns for better ventilation, are quite substantial.

Good Machinery Orders Placed on Pacific Coast

Recent machinery orders on the Pacific Coast have been good and include five high-voltage precipitation transformers of 15 kw. each, valued at $6,000, for a Redwood City cement plant; a distributing switchboard and panels, valued at $5,000, for Santa Barbara; five 15,000-volt substation circuit breakers for San Francisco, amounting to $8,500; miscellaneous switching equipment, amounting to $7,000, for the new irrigation lines out of Fallon, Nevada, and six pole-type regulators, 10 kw. each, valued at $2,500, for San Jose street lighting service. An outstanding order comprises the automatic rotary converter substation equipment and switchboard for a Bay district power company. This order was placed with the General Electric Company and valued at $130,000. Estimates will soon be submitted on the first of four units for the Brear Creek Power site on the Stanislaus River.

The Pacific Gas & Electric Company plans to spend $43,000,000 on this development, of which the first unit will cost approximately $13,000,000. Interesting motor orders include two 250-hp. units for a pump company, and 50 assorted size from ½ hp. to 1½ hp. for pumps and garage compressors.

Motor sales in the Puget Sound district were very light. Those reported include one 30-hp. unit to a Seattle flour mill; five 30-hp. units to a powder mill; six units for a cold storage plant in Yakima County, and ten units from 50 hp. down for a lumber mill in southwest Washington. The E. K. Wood Lumber Company, at Anacortes, Wash., plans the construction of a large planing mill and a battery of six dry kilns involving an expenditure of $100,000 in motors and machinery. Specifications for motors and machinery requirements for a proposed large lumber mill at Longview are expected to be out within a month.

Activity Continues in Oil Fields in St. Louis District

Activity continues in the oil fields included in the St. Louis district, with several fair-sized orders for standard oil-well pumping motors and some carload orders for pole line construction material is being received from that territory. Orders were placed by two of the power companies for switchboards to be installed in northeastern Oklahoma. A turbo-generating unit was purchased for a company in the southwestern part of the district. The contract price was said to be around $80,000. Jobbers report business keeping up to normal for the season, and a continued demand is reported for wire, conduit, receptacles, fixtures and general building construction materials. Manufacturers of switchboards and safety switches state they are receiving a number of inquiries and some good business is in prospect.

Activities of the Trade

Allis-Chalmers Earnings Are Slightly Higher for Half Year

The net income of the Allis-Chalmers Manufacturing Company, Milwaukee, for the second quarter of 1927 as reported in its quarterly earnings statement, is virtually the same as it was in the corresponding period last year. The earnings for the half year are slightly higher than they were in the first half of 1926. The comparative statement is as follows:

	1927	
	Billing	Net Profit
First quarter.....	$7,906,355	$850,163
Second quarter.....	8,666,874	831,987
	$16,573,229	$1,682,150

	1926	
	Billing	Net Profit
First quarter.....	$7,328,018	$828,401
Second quarter.....	7,354,067	826,158
	$14,682,085	$1,654,559

The net profits shown above are after provision for Federal income taxes and after deducting the quarterly dividend on the preferred stock (which was retired July 1, 1927). There is a balance available for the common equivalent to $2.09 per share, compared with $2.09 per share for the second quarter of 1926. Net profits for the six months period are equivalent, after preferred dividends, to $4.27 per share on the common stock, compared with $4.18 per share for the first six months of 1926. Bookings of new business for the first half of 1927 aggregated $15,110,813. The unfilled orders on hand on June 30 totaled $11,251,142, compared with $11,634,711 as of Dec. 31, 1926.

Westinghouse Constructs Another Arc Welded Building

Erection of the fifth arc-welded building by the Westinghouse Electric & Manufacturing Company has been started at Derry, Pa., by the Jones & Laughlin Steel Company to whom the contract was recently awarded. The building, one of the few so far to be erected by arc-welding will be a one-story mill-type structure, 460 ft. long by 303 ft. wide and 25 ft. high at its central bay. It will house kilns used in the manufacture of porcelain insulators.

All structural details will be welded in the field. This is a departure from previous practice wherein the steel members, were assembled by shop welders. The welding will be supervised by engineers of the Westinghouse company. The four Westinghouse buildings already erected by arc-welding include a five story transformer assembly building at Sharon, Pa., and a high-voltage laboratory, chemical laboratory, and a large garage, all located in the East Pittsburgh, (Pa.) works of the company.

Six Porcelain Companies Combine as Porcelain Products, Inc.

The merger of porcelain companies announced in the July 16 issue of the ELECTRICAL WORLD actually involves six companies instead of five as reported. The companies forming the merger are: The Findlay Electric Porcelain Company, Findlay, Ohio; the Federal Porcelain Company, Carey, Ohio; the General Porcelain Company, Parkersburg, W. Va.; the National Porcelain Company, Trenton, N. J.; the Ravenswood Porcelain Company, Ravenswood, W. Va., and the Cincinnati Porcelain Company, Cincinnati, Ohio. These companies have been merged under the corporate name of Porcelain Products, Inc., and the general offices will be established at Findlay, Ohio. The capital stock of the corporation is $5,000,000.

The officers of the new corporation are: J. E. Bicknell, president; F. E. Owen, vice-president; John G. Loy, secretary and treasurer; J. V. Patterson, sales manager, and H. A. Eatherton, production manager. The products of the corporation will consist of standard, special and high-tension porcelain, radio insulators, refractory porcelain, high-tension and bus bar supports and assembled porcelains for both high and low tension. The corporation states that it will carry railroad stocks in every locality to supply the porcelain needs of jobbers, power companies, railroad and telephone companies, manufacturers, dealers and contractors. The company's plants are located at Carey and Findlay, Ohio, and at Parkersburg and Ravenswood, W. Va.

General Electric Company Enters Custom Molding Field

The General Electric Company has entered the custom molding business, according to a recent announcement by E. O. Shreve, manager of the industrial department. The product will be marketed under the trade name "Textolite Moulded." For many years the company has operated, for its internal requirements, two large plants devoted to the molding of a large variety of molded forms for mechanical and electrical purposes, including radiotron bases, knobs, dials, sundry radio parts, parts of industrial control equipment, wiring devices and all forms of molded insulation. These two plants will be devoted to this new business, under the direction of H. D. Randall.

Westinghouse Gets Large Order from American Rolling Mill

An order for approximately $700,000 worth of electrical equipment has been received by the Westinghouse Electric & Manufacturing Company from the American Rolling Mill Company of Middletown, Ohio. The order covers complete electrical equipment for a continuous hot-strip mill in the Middletown plant. Included in the order are four alternating current motors, totaling 3,800 hp., eight direct current motors, totaling 18,150 hp., six motor-generator sets, having a total capacity of 13,800 kw., and a switchboard of approximately 120 panels to accommodate control apparatus.

The Westinghouse company has also received an order for two additional turbine-electric propulsion units from the United States coast guard service. The company had previously obtained an order for three propulsion units, thus bringing the total to five cutters to be so equipped.

The Lincoln Electric Company, Cleveland, manufacturer of "Linc-Weld" motors and "Stable-Arc" welders, announces the removal of the Missouri district office from 1808 Railway Exchange Building, St. Louis, to 1003 Davidson Building, Kansas City, in charge of Robert Notvest. The St. Louis district will be handled by Mr. Notvest, his time being divided between the two cities. A branch office has also been established in Toledo, Ohio, at 220 Nichols Building. A H. Homrighaus, formerly in charge of the Missouri district, will have charge of the Toledo office.

New Equipment Available

Fractional-Horsepower Condenser Motors

A line of ball-bearing, single-phase, fractional-horsepower condenser motors from $\frac{1}{15}$ hp. to $\frac{1}{2}$ hp. has been developed by the Baldor Electric Company, 4353 Duncan Avenue, St. Louis. The motor is of the induction type, built for constant or variable speed, and is for use on loads where the starting duty is not greater than full-load torque. The stator is similar to a regular polyphase motor and has two windinds, one connected to the line and the other interconnected to a static condenser which is completely inclosed with no current-carrying parts exposed. The starting current is less than that of the usual repulsion-type motor of the same size, and the motor will operate on mercury-type automatic switches. The $\frac{1}{4}$-hp. motor has a power factor of 97 per cent at full load. The manufacturer states that the magnetic action in this motor is very similar to that of a polyphase motor, so that it does not have the hum that is inherent in the usual single-phase motor.

Indicative of the electrical performance of this line of motors, the test made by the manufacturer on a $\frac{1}{4}$-hp., 110-volt, 60-cycle, 1,800-r.p.m., condenser motor is as follows:

Type	XIC
Idle amperes	1.4
Full-load amperes	2.8
Locked amperes	8.4
Idle watts	105
Full-load watts	300
Maximum torque	2.1 times full-load torque
Lock torque	1.0 time full-load torque
Efficiency	Per Cent
Quarter load	31
Half load	47
Three-quarters load	57
Full load	62
25 per cent overload	65
Power Factor	
Quarter load	84
Half load	90
Three-quarters load	94
Full load	97
25 per cent overload	95

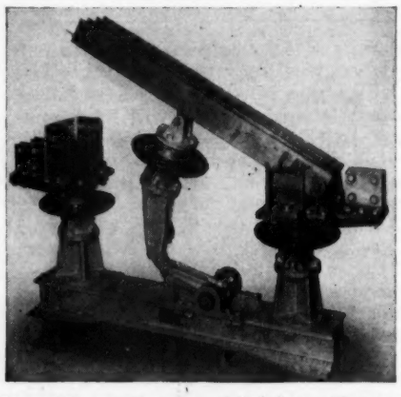
Monorail Hoist

A motor trolley electric monorail hoist that operates in 15½ in. headroom is announced by the American Engineering Company, Philadelphia, as an addition to its line of "Lo-Hed" hoists. This hoist is built in half ton and ton sizes and is similar in construction to the standard class A "Lo-Hed" hoists, except that it is mounted on an eight-wheel trolley that reduces the headroom requirement by more than 5 in. It is made for operation with alternating current at 20 ft. per minute or direct current at 20 to 40 ft. per minute, and a special high-speed hoist provides for operation at 40 ft. per minute with alternating current and 40 to 80 ft. per minute with direct current. The standard height of lift is 20 ft., but when required a lift of 25 ft. can be provided. Four ropes are used in the control, or remote control of both hoist and trolley motors can be provided.

The manufacturer states that this hoist has been designed to meet the need for a means of handling and conveying materials under minimum headroom conditions and for lifting and moving bulky objects over crowded shop or warehouse floors, where clearance is at a minimum. It also permits the stacking om materials to a greater height in warehouse and factory store rooms. Hyatt bearings are used on the gear shafts and in the trolley wheels, and a ball-bearing fully-inclosed motor designed especially for hoist service is used. The drive between the motor and drum is of the spur gear type and runs in oil, and Alemite lubrication is provided on all bearings not automatically lubricated by the oil bath.

Gang-Operated Switch

A 4,000-amp., 11,000-volt gang-operated disconnecting switch arranged for vertical mounting has been developed



SINGLE-POLE UNIT OF 4,000-AMP. DISCONNECTING SWITCH FOR GANG OPERATION

by the Hi-voltage Equipment Company, 3305 Croton Avenue, Cleveland, Ohio. The main contact has self-aligning contact fingers that engage both sides of the four copper bars that make up the blade. A similar type of contact is used on the hinge end, the pivot or mechanical hinge being independent of the contact, as shown in the illustration. The switch is said to be well protected against the weather and is easily operated.

Strain Meter

The Iler line "tensiometer" which may be used to measure the pull of guy wires, test strain, weigh suspended loads, and test for guy wire overloads has been placed on the market by the Iler Electric Service Company, 917 Hillman Street, Youngstown, Ohio. The instrument takes the place of a dynamometer, but in using it the wire or cable does not have to be cut. The "tensiometer" is snapped on the wire cable or rope the strain of which is to be measured, but is not clamped nor is the wire or rope scratched or marred in any way. A few turns of a nut is all that is necessary, and this can be done without a wrench. When the meter is placed on the wire it puts a 1-in. deflection in a 2-ft. length, the force necessary to make that deflection being proportional to the strain on the wire. A reading in pounds is then obtained from the dial. The unit is available in two types, model J with a capacity of 3,000 lb., and model K having a capacity of 6,000 lb.

Lifting Magnet

The new type SA lifting magnet, placed on the market by the Electric Controller & Manufacturing Company, Cleveland, is said by the manufacturer to have greater strength and better lifting capacity owing to a coil spider of composite construction with a body of cast steel and a flange of cold rolled brass. To prevent pole shoe breakage the outer pole shoe is extended upward to fit against a machined surface on the outside of the mechanical housing. A steel plate, ½ in. thick, is bolted in place at the top of the magnet, to prevent injury to the incoming lead-wires, because of the crushing effect of the crane hooks and chains. The company claims that this new magnet will outlift and outlast all of its previous designs.

Phantom Test Load

A lightweight phantom test load having a capacity of 20 amp. and weighing only 3 lb. has been placed on the market by the States Company, 43 New Park Avenue, Hartford, Conn. The unit is built with a bakelite body and may be attached to a standard test meter. It is supplied with two carbon rheostats, one for full load and one for light load adjustment, also a two-scale indicator and single-pole double-throw full load-light load switch. The manufacturer states that it is simple to operate and has a good power factor.

Across-the-Line Starter

A small across-the-line starter for alternating current motors up to 5 hp. and which provides push-button control for starting and stopping as well as thermal overload protection and no-voltage protection, has been developed by the Cutler-Hammer Manufacturing Company, Milwaukee. It is known as the C4H 9586 "AAA" starter. Push buttons are provided in front cover of the case. The manufacturer states that the small size of this starter in most cases will permit of mounting it where the control station would ordinarily be placed and the extra wiring and cost of a push-button station is thus saved. If desired, one or more push-button stations may be used with the starter.

The type of contactor developed for use in this starter consists of a roller which is forced between two fingers to complete the circuit. A double break and a wiping contact are thus secured, and the manufacturer states that this arrangement reduces arcing to a negligible minimum. To adapt the starter for any horsepower within its rating it is only necessary to insert the proper size heater coils in the thermal overload relay. The starter can also be furnished without the case to machinery builders for incorporation in machinery design as standard equipment.

New Trade Literature

CABLE-DRAG SCRAPER.—Catalog No. 95 issued by the R. H. Beaumont Company, 319 Arch Street, Philadelphia, describes the Beaumont cable-drag scraper system for handling sand, gravel, stone and other bulk materials. A number of illustrations are given showing various applications of the cable-drag scraper system. Specifications and a table of handling capacities of the Beaumont-LeClair drag scraper are included. The Beaumont double-drum scraper winding machines are also illustrated and described.

CONDENSERS.—A booklet issued by the McCord Radiator & Manufacturing Company, Detroit, describes and illustrates the McCord "Spiral Fin" condensers for the refrigeration industry. Illustrations showing the various types of McCord condensers are included.

FUSES AND DISCONNECTING SWITCHES, LINE EQUIPMENT, ETC.—Bulletin No. 502 issued by the W. N. Matthews Corporation, 3722 Forest Park Boulevard, St. Louis, describes and illustrates the Matthews "Fuswitches" and disconnecting switches for voltages up to and including 15,000 volts. The company is also distributing bulletins Nos. 701 and 802, covering its slack pullers and "Scrulix" anchors respectively, as well as a bulletin covering its mechanical painting equipment.

DISCONNECTING SWITCHES. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing leaflet 20,318, describing its new type RW disconnecting switches designed for 200, 400 and 600 amp., 7,500 and 15,000 volts, and 400 and 600 amp., 25,000, 37,000, 50,000 and 73,000 volts. Illustrations showing the different designs of switches and diagrams of various parts of the switches are included.

BELL.—A leaflet issued by Edwards & Company, Inc., 140th and Exterior Streets, New York, describes its new No. 551 alternating-current bell for signaling purposes, such as traffic signals, mines, warehouse, etc.

VENTILATING FANS.—"Buffalo Conoidal Fans" is the title of catalog No. 422, issued by the Buffalo Forge Company, P. O. Box 985, Buffalo, N. Y. It describes the Buffalo duplex and turbo "Conoidal" fans. Illustrations showing the various types and typical installations of the fans are given. Curves showing comparison of pressure characteristics and comparison of horsepower characteristics of the turbo and duplex "Conoidal" fans are included.

SWITCHING EQUIPMENT. — Bulletin GEA-460A issued by the General Electric Company, Schenectady, N. Y., describes and illustrates the General Electric outdoor station equipment, type TA-1 horn-gap switch, designed for horizontal mounting on outdoor structures. The company is also distributing bulletin GEA-582, covering its automatic switching equipment for synchronous motor-generators in lighting service.

THERAPEUTIC ARC CARBONS. — A bulletin issued by the National Carbon Company, Inc., Cleveland, describes the various types of the National therapeutic arc carbons. Spectrograms and other data on this new product of the company are included.

TRANSMISSION-LINE CALCULATOR. —A folder distributed by Robert Adams, 1012 Turks Head Building, Providence, R. I., describes and illustrates the Adams transmission line calculator for the rapid calculation of alternating-current circuits. It contains a reproduction of the transmission chart with instructions for using the transmission-line calculator.

ELECTRIC EQUIPMENT FOR COUNTRY GRAIN ELEVATORS. — "Complete Electric Equipment for Country Grain Elevators" is the title of bulletin GEA-767 issued by the General Electric Company, Schenectady, N. Y. A detailed description is given of the new totally inclosed, fan-cooled grain elevator motors, types KT, FT and SCR and a diagram of a typical electric installation for a country grain elevator is included.

ELECTRIC MELTING POTS, ETC.—Leaflet TA-14 issued by the Harold E. Trent Company, 439 North Twelfth Street, Philadelphia, covers the Trent electric melting pots and other electrically heated industrial equipment. An illustration showing the Trent tilting-type portable melting pot is included.

FUSE BLOCKS AND SWITCHES.—Catalog No. 41 issued by the Frank Adam Electric Company, Drawer 22, Main Post Office, St. Louis, describes and illustrates its fuse blocks, knife switches, flush range switches, etc.

INDUCTION MOTOR PANELS.—Bulletin GEA-763 issued by the General Electric Company, Schenectady, N. Y., describes and illustrates the General Electric induction motor panels, isolated type for motors with wound or squirrel-cage rotors. These panels are designed for use with types MT and KT induction motors driving centrifugal pumps and compressors, fans, gyratory crushers in cement plants and similar machinery.

HIGH-VOLTAGE SWITCHES.—The Hi-Voltage Equipment Company, Cleveland, is distributing the first section of its new catalog, covering air break switches, gang-operated disconnecting switches, Hi-voltage fuses, choke coils, bus supports, connectors, etc. Many illustration showing various types of the equipment, drawings and operating data are included.

HIGH-TENSION SWITCHES.—Bulletin No. 12 issued by the Pacific Electric Manufacturing Company, 5815 Third Street, San Francisco, describes and illustrates the Pacific type "S" group-controlled switches. Schedules of the various types of "S" switch data are included as well as dimension diagrams.

INHALATOR.—The Mine Safety Appliances Company, Braddock Avenue and Thomas Boulevard, Pittsburgh, is distributing a folder calling attention to the "H-H" inhalator for administering oxygen to victims of asphyxia from carbon monoxide, gas, smoke and other causes.

PANELBOARDS, SWITCHBOARDS, KNIFE SWITCHES, ETC. — The Plainville Electrical Products Company, Plainville, Conn., has issued catalog No. 1-0 covering its panelboards, switchboards, fuse reducers, knife switches, etc. It contains illustrations showing various types of panelboards and switchboards and dimension tables of same. A diagram of connections of a metering panel is included.

PARALLEL RULE ATTACHMENT. — The C. F. Pease Company, 850 North Franklin Street, Chicago, is distributing a leaflet covering the Pease parallel rule attachment that can be used with any drawing table.

GROUNDING APPLIANCES. — Bulletin No. 77 issued by the Groundulet Company, Newark, N. J., covering its various types of groundometers and ground heads and points. Diagrams for a typical grounding system for a generating station and a suggested grounding system for an outdoor substation are included.

CENTRIFUGAL PUMPS.—Bulletin No. W613 issued by the Worthington Pump & Machinery Corporation, 115 Broadway, New York, entitled "High-Efficiency Ball-Bearing Centrifugal Pumps for General Service" describes the various types of the Worthington centrifugal pumps. Curves showing typical performances are included.

UNIT HEATERS.—A catalog issued by the American Blower Company, 6000 Russell Street, Detroit, describes and illustrates a small new style "Venturafin No. 2" unit heater for use in stores, small factories, garages, offices, etc.

DISTRIBUTION TRANSFORMERS. — Leaflet 20,321 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., covers its types SB and SKB distribution transformers for industrial applications. Approximate outline dimensions of both the oil-field and shovel types are included.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MARLBORO, MASS.—The Marlboro Electric Company is planning to build transformer stations in Northfield and Berlin, to cost about $40,000.

NEW HAVEN, CONN.—Plans have been filed by the United Illuminating Company for the construction of a substation at Wallace and Wooster Streets.

Middle Atlantic States

SCHENECTADY, N. Y.—Permission has been granted the Adirondack Power & Light Corporation to erect a 110,000-volt transmission line in the town of East Greenbush, connecting with the Menans-Stephentown transmission line and extending 5 miles. Authority has also been granted the company to build a transmission line in the town of North Greenbush and to extend its lines into Danube to serve both towns.

PHILADELPHIA, PA. — The Philadelphia & Reading Railroad Company, Twelfth and Market Streets, is planning to install an electric substation at its proposed passenger terminal at Broad and Huntingdon Streets, to cost about $2,000,000. Clark Dilienback is company engineer.

PLYMOUTH MEETING, PA. — Plans are under way by the Philadelphia Electric Company for the construction of a local substation. John T. Windrim, Commonwealth Trust Building, Philadelphia, is architect.

WILLIAMSPORT, MD. — The Potomac Edison Company, Hagerstown, is planning the erection of a transmission line from Williamsport to Shepherdstown and vicinity.

HENRY, VA.—The Community Electric Service, recently organized, is planning to build a transmission and distributing system. The company has contracted with the Appalachian Electric Power Company, Bluefield, W. Va., for power supply.

MOUTH OF WILSON, VA.—Plans are under way by the Fields Manufacturing Company for the installation of a power plant on the New River for service at its local textile mill.

RICHMOND, VA.—The Virginia Electric & Power Company contemplates an expenditure of $6,652,389 during the next months for extensions, equipment and improvements, covering its system in Virginia and North Carolina. The work will include laying an underground transmission line from the Twelfth Street power station to the West substation at Harrison and Clay Streets, to cost about $140,000; extending its high-tension lines in northeastern Carolina; building the Reeves Avenue power station in Norfolk, at a cost of about $5,000,000, an additional storehouse, etc.

WASHINGTON, D. C.—Bids will be received by the Supervising Architect, Treasury Department, Washington, until Aug. 4, for electric lighting equipment and fixtures for various Government buildings.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until Aug. 10, for a quantity of electric wire and cable, fuses, outlet boxes, etc. (Circular 1818). Bids will also be received until Aug. 2 for glass reflectors, rod and sheet insulation, etc. (Panama Circular 18119).

North Central States

HUDSON, MICH.—The Southern Michigan Light & Power Company plans to erect a transmission line to Gaines, Lennon, Swartz Creek and vicinity.

TRAVERSE CITY, MICH. — The City Council is considering the installation of a steam-operated electric plant for auxiliary service, to cost about $78,000. Burd, Giffels & Hamilton, Grand Rapids, are engineers.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Aug. 5 for lead-covered cable for the Division of Light and Power.

LOUISVILLE, KY.—Plans are under way by the Kentucky Utilities Company to build a 66,000-volt double-circuit, steel tower transmission line from the Earlington power house to Morganfield, 38 miles long. The project will include a substation at Earlington. The total cost is estimated at $310,000. The construction of a 66,000-volt line from Barlow, Ky., to Cairo, Ill., (8 miles long) to cost about $150,000 has been authorized. A 33,000-volt line will be built from Madisonville to Hanson, with a distribution system in Hanson, to cost about $25,500.

MURRAY, KY.—The erection of a high-tension line from Murray to Mayfield is under consideration by the Kentucky-Tennessee Light & Power Company, Bowling Green.

FORREST, ILL. — Authority has been granted the Central Illinois Public Service Company, Springfield, to erect a 33,000-volt line between Forrest and Strawn. Service will be supplied to residents along the line.

ELDORA, IOWA — The Central States Electric Company plans to erect a transmission line from Jewell to Eldora, where

connection will be made with transmission system from Cedar Rapids.

VANDALIA, MO.—Plans are under way by the Missouri Power & Light Company, Mexico, for the erection of a 33,000-volt line from Vandalia to Wellsville, a distance of 22 miles, and the reinsulation of the line from Mexico to Wellsville, 22 miles, increasing the voltage of the latter line from 16,000 to 33,000 volts.

AYR, N. D.—Contract has been awarded by the City Council to the Otter Tail Power Company. Fergus Falls, Minn., to install an electric distribution in Ayr, and also for the erection of a transmission line from Ayr to connect with the high-tension line of the company.

FARGO, N. D.—The City Commission is considering the installation of a police-alarm system, with central station.

Southern States

WINSTON-SALEM, N. C.—The Southern Railway Company, Charlotte, plans to build a power plant at its proposed local terminal and repair shops. The cost of the entire project is estimated at $500,000.

DENMARK, S. C.—The Edisto Public Service Company, plans to erect a transmission line from Windsor to Ellenton via Robbins, and also a line to Dunbarton, and vicinity.

BALL GROUND, GA. — The Georgia Power Company, Atlanta, which has acquired the local electric system, plans to erect a short transmission line from its high-tension line near the town, and to install a 450-kva. transformer substation.

FOLKSTON, GA.—The Charlton County Power Company is planning to build an electric light and ice plant, to cost about $110,000. The equipment will include Diesel oil engines.

DECATUR, ALA.—The Southern Cotton Oil Company, New York, plans extensions and improvements in the power department at its local mill, including the installation of generating equipment, etc., to cost about $50,000.

RIPLEY, MISS.—The Ripley Light & Power Company plans extensions and improvements in its power plant and system.

SHUBUTA, MISS.—Plans are under way by the Mississippi Power Company, Gulfport, for extensions to its local power plant.

OSCEOLA, ARK.—The City Council contemplates extensions and improvements in the municipal electric light and power plant, to cost about $30,000.

CHEYENNE, OKLA.—The Southwestern Light & Power Company, Oklahoma City, which has been granted a franchise here, plans to extend its transmission line (14 miles) to Cheyenne and to build a distribution system to supply service here.

HARRAH, OKLA—Plans have been approved by the Oklahoma Gas & Electric Company for an addition to its electric generating plant at Horse Shoe Lake, near Harrah, to increase the output to about 80,000 hp.

HOWE, OKLA. — The Lincoln Power Company is contemplating the erection of a 33,000-volt transmission line from Howe to McAlester, about 65 miles long, at a cost of about $75,000. D. Reid Smith, Fort Smith, Ark., is engineer.

ORANGE, TEX.—The Gulf States Utilities Company contemplates tthe installation of a 40,000-hp. generating unit in its Neches power plant.

PELLY, TEX. — The Houston (Tex.) Lighting & Power Company has taken over the local electric plant, which will be operated as the Goose Creek Division. The Houston company is planning to extend its service from Goose Creek to Crisby, Barbers Hill and Pringle, with an extension to Cedar Bayou and Woosters.

Pacific and Mountain States

ABERDEEN, WASH.—A franchise has been granted to the Grays Harbor Railway & Light Company for the erection of a high-tension transmission line along the state roads from Mayfield connecting Grays Harbor and Willapa Harbor.

KLAMATH FALLS, ORE. — The City Council has authorized the installation of an ornamental lighting system on a number of streets, in connection with the establishment of a new lighting district. D. J. Sumwalt is city engineer.

CORONA, CAL.—The City Council has rejected bids submitted for an ornamental lighting system on the Grand Boulevard, totaling 181 concrete standards. New bids will soon be asked for.

LOS ANGELES, CAL.—Plans are under way by the Los Angeles Gas & Electric Company for an addition to its substation at 1337 Lawrence Street.

MARIPOSA, CAL. — The San Joaquin Light & Power Corporation, Fresno, plans to extend its transmission line in this vicinity, connecting with the present Mariposa-Bagby power line.

PASADENA, CAL.—Bids will soon be asked by the City Council for the installation of an ornamental lighting system on Oak Knoll Avenue and other streets in this section, using iron and copper standards maintained by underground wires.

SAN JOSE, CAL.—Bids will soon be asked by the City Council for the installation of an ornamental lighting system on Second Street comprising 52 cast-iron standards maintained by underground wires. William Popp is city engineer

BEAVER CITY, UTAH.—The City Council has applied to the State Water Department for permission to use water from the Beaver River for a proposed municipal hydro-electric plant.

TUCSON, ARIZ.—The City Council is considering the installation of an ornamental lighting system on Main Street. George T. Grove is city engineer.

TUCSON, ARIZ.—Bids will be received by the City Council until Aug. 19, for the construction of a central fire-alarm station. H. M. Starkweather is architect.

BUTTE, MONT.—Bids will soon be asked by the City Council for the installation of an ornamental lighting system on East Park Street.

COLORADO SPRINGS, COLO.—The City Council has rejected all bids submitted for the installation of an ornamental lighting system on Kiowa Street, and proposes to handle the project by day labor. F. O. Ray is city engineer.

Canada

TORONTO, ONT.—The Hydro-Electric Power Commission of Ontario is planning to erect a large terminal station at Leaside, near Toronto, for the purpose of receiving the 260,000 hp. contracted for under an agreement with the Gatineau Power Company, to be transmitted over the 220-kv. 200-mile line from Ottawa. The station will cost several million dollars.

BELLE RIVER, QUE.—Bray, Caron & Duke, Ltd., 10 St. Peters Street, plans to build a new power plant in Two Mountains County, to cost about $115,000, with transmission line.

Electrical Patents

Announced by U. S. Patent Office

(Issued July 5, 1927)

1,634,944. ALTERNATING-CURRENT MOTOR; J. I. Hull, Schenectady, N. Y. App. filed April 23, 1924. Arranged to start with induction-motor characteristics and to be accelerated from rest to synchronous speed without the use of external devices.

1,634,957. ELECTRODE HOLDER; L. E. Muller, Los Angeles, Cal. App. filed Oct. 26, 1925.

1,634,959. TRANSFORMER FOR ELECTRIC ARC CUTTING, REPAIRING, AND WELDING APPARATUS; F. C. Owen, Fayetteville, N. C. App. filed Nov. 19, 1925.

1,635,000. CONTINUOUS-CURRENT GENERATOR; T. C. Lennox, Pittsfield, Mass. App. filed Aug. 20, 1925. For generating high-voltage direct currents.

1,635,001. SYNCHRONOUS RECTIFIER; T. C. Lennox, Pittsfield, Mass. App. filed Aug. 20, 1925.

1,635,002. CONTINUOUS-CURRENT TRANSFORMER; T. C. Lennox, Pittsfield, Mass. App. filed Aug. 20, 1925. For transforming direct-current energy from one voltage to another voltage.

1,635,005. SLOW MAGNET; N. E. Norstrom, Chicago, Ill. App. filed Dec. 16, 1926. Which will serve as a power drive when operated by an alternating current of low frequency.

1,635,028. ELECTRIC DOOR LOCK; H. B. Burr and M. A. Grieve, Los Angeles, Cal. App. filed May 10, 1926.

1,635,029. FILM CUT-OUT; H. E. Butler, Scotia, N. Y. App. filed Dec. 27, 1926. For series lighting circuits.

1,635,041. CONTROL FOR ELECTRIC FLATIRONS; J. Harper, Portland, Ore. App. filed April 29, 1925.

1,635,042. REACTOR; J. S. Hebrew, Masury, Ohio, and E. E. Ross, Sharon, Pa. App. filed May 11, 1925.

1,635,044. ELECTRIC SWITCH; W. Ile, Jackson, Mich. App. filed May 20, 1925. Of the snap-toggle type; for a socket.

1,635,047. DYNAMO-ELECTRIC MACHINE; H. T. Lang, Cleveland, Ohio. App. filed March 10, 1925. Small high-speed motors for appliances.

1,635,049. EXPULSION FUSE; R. R. McGee, Ballston Lake, N. Y. App. filed July 13, 1925.

1,635,055. ALLOY FILAMENT; A. Pacz, Cleveland, Ohio. App. filed Jan. 15, 1920.

1,635,056. OUTLET; H. T. Paiste, Philadelphia, Pa. App. filed July 1, 1925.

1,635,060. INDUCTION VOLTAGE REGULATOR; L. W. Thompson, Schenectady, N. Y. App. filed March 1, 1927.

1,635,061. AUTOMATIC RECLOSING CIRCUIT-BREAKER SYSTEM; O. C. Traver, Schenectady, N. Y. App. filed Dec. 30, 1926.

1,635,064. TRANSFORMER; E. A. Wagner, Pittsfield, Mass. App. filed Dec. 15, 1926. High-reactance transformer.

1,635,075. COMBINED ELECTRICAL AND MECHANICAL SAFETY LOCK FOR VAULT DOORS; W. C. Dillon, Fort Dodge, Iowa. App. filed Sept. 30, 1920.

1,635,128. INDICATOR; J. Klasnich, Cleveland, Ohio. App. filed Sept. 26, 1923. Street car indicator.

(Issued July 12, 1927)

1,635,170. SWITCH SOCKET; R. B. Benjamin, Chicago, Ill. App. filed March 1, 1922. Push-bar type.

1,635,200. WIRE CONNECTER; J. Zilliox, Orchard Park, N. Y. App. filed July 19, 1922.

1,635,208. ELECTRIC-ARC WELDING APPARATUS; J. H. Ezendam, Amsterdam, Netherlands. App. filed Jan. 2, 1926.

1,635,217. PROCESS OF WELDING MANGANESE STEEL TO CARBON STEEL; F. H. Kirchman, Washington, D. C. App. filed Oct. 5, 1926.

1,635,257. SELF-LUBRICATING BRUSH FOR ELECTRICAL APPARATUS; C. E. Chapin, Greenwich, Conn. App. filed Nov. 2, 1920.

1,635,293. WIRE CONNECTER; Wm. R. Sommer, R. Ree, C. Kerkhof, Hackensack, N. J. App. filed Oct. 8, 1923.

1,635,312. ELECTRICAL CONNECTER AND TERMINAL BLOCK; F. Diehl, Elizabeth, N. J. App. filed May 19, 1921. Plug and detachable socket type.

1,635,319. ELECTRODYNAMIC POWER TRANSMITTING MECHANISM; J. F. Gill and J. N. Chaviara, Liverpool, England. App. filed Jan. 25, 1923.

1,635,320. INCANDESCENT ELECTRIC LAMP; J. A. Heany, New Haven, Conn. App. filed June 28, 1918.

1,635,323. CAP AND SHELL FASTENING FOR LAMP-SOCKET CASINGS; W. Ile, Jackson, Mich. App. filed July 2, 1925.

1,635,351. STORAGE-BATTERY TERMINAL CONNECTION; G. Spurgeon, Hilliburg, Ind. App. filed June 30, 1922.

1,635,507. ATTACHMENT FOR ELECTRIC EXTENSION PLUGS; E. T. Seasock, Wall, Pa. App. filed Nov. 4, 1926. A non-detachable connection for an extension line.

1,635,544. CIRCUIT BREAKER; L. N. Crichton, Wilkinsburg, Pa. App. filed Sept. 27, 1922. Utilizing magnetic forces incident to the flow of current for assisting in the rupture of the circuit.

1,635,552. CHAIN GUIDE; C. P. La Shelle and W. A. Behrens, New York, N. Y. App. filed Sept. 2, 1921. For lamp socket.

1,635,574. AUTOMATIC STATION; C. E. Carey, Wilkinsburg, Pa. App. filed April 2, 1924. For supplying energy to a plurality of direct-current load circuits.

1,635,581. ELECTRIC SWITCH; J. W. Meadowcroft, Philadelphia, Pa. App. filed Jan. 18, 1922. For use in connection with electric welding machines.

1,635,582, 1,635,583. ELECTRIC WELDING MACHINE; J. W. Meadowcroft, Philadelphia, Pa. Apps. filed June 30, 1923, and Aug. 15, 1925. Spot-welding machine.

1,635,586. SIGNALING SYSTEM FOR ELEVATORS; W. S. Smith, Cambridge, Mass. App. filed Nov. 23, 1922.

1,635,591. ELECTRIC HEATER FOR FLUIDS; J. H. Valiquette, Springfield, Mass. App. filed March 1, 1926. Heater for radiators, boilers, and the like.

1,635,595. ELECTRICAL MEASURING INSTRUMENT; E. F. Weston and G. Carpenter, Newark, N. J. App. filed June 24, 1925. Movable coil type.

1,635,598. ELECTRIC VEHICLE TRANSMISSION; H. K. Whitehorn, Maidstone, England. App. filed March 29, 1923.

1,635,636. HEATER; F. Rayman, Chicago, Ill. App. filed April 22, 1926. Portable heater including humidifying means.